

The New Zealand Journal of Agriculture.

VOL. 45.

WELLINGTON, 20TH SEPTEMBER, 1932.

No. 3.

THE CURD TEST FOR MILK-GRADING.

G. M. MOIR, M.Sc. (N.Z.), A.I.C. (London), Ph.D. (Reading), Dairy Chemist,
Wallaceville Dairy Laboratory.

ALTHOUGH all connected with our cheesemaking industry may not be agreed as to the desirability of milk-grading, yet in recent years many more have become converted to the need for progress in this direction. This development has been materially assisted by the success which has attended the introduction of cream-grading. Moreover, in certain districts where special facilities have been available, local enthusiasm has made it possible for milk-grading to be thoroughly tried out, with the result that the factories concerned have been enabled to make more easily and regularly cheese of highest quality. Thus a considerable body of opinion has been developed in favour of it, and no doubt as time goes on the difficulties which stand in the way will be overcome and the principle become firmly established in the experience of all concerned.

The purpose of this article, however, is not to discuss the need for milk-grading. What follows has been written not so much with the object of comparing the curd test with other tests, but rather to set down some of the special advantages which it possesses as a criterion of milk for cheesemaking.

All experienced dairy bacteriologists realize that no one test alone is entirely satisfactory for determining the hygienic quality of milk. After carefully studying information obtained by diverse English, American, and Continental investigators of repute, Dr. A. T. R. Mattick (head of the Bacteriological Department, National Institute for Research in Dairying, Reading, England) writes⁽¹⁾: "One fact emerges from a consideration of the literature upon the methods at present in use for determining the bacteriological content of milk—viz., no one method is capable of giving exact information as to the numbers of living bacteria present." It follows, therefore, that 100 per cent. efficiency cannot be expected of any test.

Again, it is quite possible that many tests which have been found exceedingly valuable for other purposes—*e.g.*, for control of city milk-supplies—will not necessarily be the best for judging

cheese-milk. Milk for city supply must, among other things, be specially free from souring organisms of the *Streptococcus lactis* type. These very common organisms, however, are of the same type which the cheesemaker grows in his starter culture to add to the milk to enable him to make the best cheese. Consequently, the presence in cheese-milk of a proportion of souring organisms may up to a point be desirable. However, it is not wise to encourage the milk-producer to permit these souring organisms to grow in his milk, because he may easily develop numbers which would spoil the milk for cheesemaking, or at the same time he may easily introduce large numbers of objectionable types.

Leaving aside the question of actual numbers, a test of cheese-milk should, above all, sort out the milks rich in objectionable types of bacteria, such as those which give rise to gassy curds in the vat and subsequent unclean and off-flavours in the mature cheese. This is the special virtue of the curd test, which in fact picks out milks heavily contaminated with organisms of the coliform type.* Dairy bacteriologists have repeatedly emphasized the fact that tests which will reveal the coliform types have an established value for controlling milk-supplies of all kinds. This was pointed out at the World's Dairy Congress, 1928⁽²⁾ by the late Dr. R. Stenhouse Williams (Research Professor in Dairy Bacteriology at the National Institute for Research in Dairying, Reading, England). Mattick⁽¹⁾ cites experimental evidence from which he concludes: "The presence of coliform organisms in numbers in fresh milk is, therefore, evidence of carelessness at some stage in the handling. In many cases they are of faecal origin. . . . In the examination of farm samples, therefore, the coliform test is of great value." Tests for coliform organisms in milk are discussed in the latest edition (1928) of the well-known textbook on "Dairy Bacteriology" by Dr. B. W. Hammer, Professor of Dairy Bacteriology at the State College of Iowa, which is one of the principal dairying States in America. He points out⁽³⁾ that although milk may have a comparatively low total count due to adequate cooling, yet at the same time excessive numbers of coliform organisms may be present due to contamination.

Quite recently Canadian investigators, McGrady and Langevin⁽⁴⁾, have emphasized the value of the coliform test as an adjunct to the plate count, which is agreed to be the most reliable method of estimating the numbers of bacteria in milk of the highest quality. They used coliform tests in duplicate, together with plate counts, to discover sources of contamination of high-grade pasteurized milk which in most cases had a plate count of less than 30,000 bacteria per cubic centimetre. They make the following observations: "Both coli-aerogenes determination and plate counts were necessary for the detection of recontamination. Of the two methods the coli-aerogenes

* Organisms of the "coliform type" are so called because they are found in large numbers in the colon or lower intestine of animals. These germs are therefore excreted in the faeces, and consequently cow-manure, dirt, and dust about the cow and the cow-shed are usually heavily infected therewith. Very similar organisms are found associated with the dust of grain and fodder. These organisms are sometimes referred to as the "coli-aerogenes group." Several other names are often used, but throughout this discussion the name "coliform" will be used for simplicity to refer to them.

yielded the sharper, and therefore the more significant, as well as the more consistent results in those cases where the organisms were found."

The same authors also say: "Particular attention is invited to the consistency of the coli results as compared with the plate counts; the latter may vary greatly, but the coli figures are usually maintained from stage to stage. The striking significance of the coli results, where positive, is also in marked contrast to the uncertain significance of many of the differences in plate counts." It is obvious from these results that milk of apparently thoroughly satisfactory sanitary quality can be seriously contaminated with coliform organisms which are located at one or more particular spots in an otherwise clean city milk-bottling plant. Obviously, similar contamination may readily occur in a milking-machine. Mention will be made later of the value of the curd test for detecting such contaminations in milking-machines.

Apart from the value of the coliform organisms as indicators of the sanitary conditions associated with the handling of the milk, the presence of these organisms in cheese milk is particularly objectionable for other reasons. Evidence is available from three distinct sources. First, fundamental researches⁽⁵⁾ have shown that *B. coli* will produce chiefly acid and gas in a medium like milk, where in addition to protein there is a fermentable carbohydrate such as lactose (milk-sugar). The organisms do not attack the protein but live on the milk-sugar. If, however, the sugar is removed they begin to attack the protein, which they decompose, producing among other things foul-smelling objectionable substances such as indole and skatole, which have characteristic faecal odours. Now this is exactly what is liable to occur in cheese, for after a week little milk-sugar is left, and after a fortnight the remainder has completely disappeared, so that the coliform organisms must attack the protein (casein). Second, that this actually occurs in cheese has been proved beyond doubt by experiments carried out by Dr. Whitehead, Bacteriologist at the Dairy Research Institute, Palmerston North. In these he added to pasteurized milk heavy doses of coliform organisms prior to using the milk for cheesemaking. On different days different coliform cultures were used, and each day control cheeses were made from the same pasteurized milk without the addition of these particular organisms. In both cases the usual amount of starter was added to each vat. In spite of the large inoculation with gas-forming bacteria the experimental cheese showed no sign of gas-holes, but, what is much more important, all developed objectionable off-flavours, variously described as "unclean," "cowy," "like putrid meat." Moreover, these off-flavours were more pronounced when the experimental cheeses were more mature, but were entirely absent from the control cheese to which no coliform organisms had been added. Third, the evidence obtained from the two foregoing lines of fundamental research in effect only confirms what has long been realized by experienced and observant cheese-makers, who well know that gassy curds are liable to make cheese which develops off-flavours while maturing.

In the modern literature of dairy science comparatively few references are to be found to the curd test, because in the laboratory

examination of milk a more refined coliform test is available. In his textbook on "Dairy Bacteriology" Hammer emphasizes the value of the Wisconsin curd test, which was introduced at the end of last century. After describing the method of obtaining the pat of curd he says: "If it is solid throughout, shows no sliminess at the surface, and has an agreeable odour, the milk was probably free from organisms that would be objectionable in cheesemaking, while gas-holes in the curd, sliminess, objectionable odours, &c., show the presence of organisms that can be expected to cause undesirable conditions in cheese; in some instances the curd is so full of gas-holes that it may be spongy. Milk with a very high bacterial count may give a desirable type of curd and another lot with a low count may give a very undesirable curd, so that the test is of no value in comparing samples of milk from the standpoint of their keeping-quality."

In 1929 I visited the South German Dairy Research and Experiment Station at Weihestephana, which is ten or twelve miles distant from the nearest town, Munich. This institution is part of a large and old-established agricultural experiment station which is surrounded by typical Bavarian farm-lands where for centuries agricultural pursuits, including buttermaking and cheesemaking, have been carried on. I was fortunate in meeting there the dairy bacteriologist, Dr. K. J. Demeter, who has had considerable experience both in Germany and in America. When the subject of the grading of cheese milk was discussed he introduced one of his assistants, who explained to me a curd test which they have developed for judging the suitability of milk for cheesemaking⁽⁷⁾. This test, called the "rennet curd test" (*labgarprobe*), they regard as the most important for this purpose. A full account of this curd test and other simple tests for milk-grading has recently been published by Zeiler and Berwig in a German journal* dealing with dairy science⁽⁸⁾. The authors have subjected the curd test, with various modifications, to a very exhaustive examination and comparison with other tests. For a period of three years milk used for cheesemaking has been regularly examined, so that hundreds of comparisons are available; for example, the results of 7,564 comparisons between the curd test and fermentation test are tabulated.

The curd test used by Zeiler and Berwig is carried out by adding to 50 c.c. of milk 2 c.c. of a fresh suitably diluted rennet solution. The tube containing the milk is set for twelve hours in a water bath at a temperature of 102° F. The curd is then removed from the whey, cut, and examined for form, texture, and flavour. They point out that a similar test was introduced about the year 1888 by Bumann, who cut the curd to drain off the whey and used a kind of mould box in which to collect it to form a "little curd." Owing to its bothersome nature Bumann's apparatus was little used and for many years was quite forgotten. Essentially the same principle is used in the Wisconsin curd test, which also is tedious to operate in large numbers. However, by means of the apparatus known as the "New Zealand curd test," elaborated by Messrs. Singleton, Morgan, and Syron at the Wallaceville Dairy Laboratory, a great deal of time and trouble can be saved⁽⁹⁾.

* I am indebted to the Dairy Research Institute for the loan of this journal in order to enable me to translate the article.

The temperature of 100°-102° F. used for the curd test has a special significance, for it is recognized that coliform bacteria grow faster than do the lactic-acid bacteria at this temperature, in the vicinity of which the cheesemaking operations are conducted. It is therefore fair that a test for grading milk for cheesemaking should make the conditions of temperature favourable for discovering the influence exerted by the coliform organisms upon the manufacture and subsequent ripening of the cheese.

The unquestioned superiority of the rennet curd test was established by Zeiler and Berwig in forty-eight experiments in which cheese was made from the same milk, which was judged both by the fermentation test and the rennet curd test. The properties of the little curds from the latter definitely agree well with cheese prepared from the same milk, especially in respect to the porosity (holes) of the material. Further, many tests show that not only the fresh cheeses but also the ripe ones show good agreement with the little curds.

A point in favour of the German rennet curd test (where the curd remains uncut in the whey) is that it can be done with rather less milk. Sometimes, owing to gassy fermentation, the uncut curd assumes peculiar shapes, but any difficulty in judging the results on this account can soon be overcome after a little experience. These peculiar shapes usually occur in curds which contain so much gas that they float to the surface and so become crumpled up. By using Bumann's apparatus with mould boxes the German scientists obtained little curds of a similar form, which, in their opinion, provided a better comparison of different milks than did their rennet curd test.

A further improvement is provided in the time saved by the New Zealand curd test apparatus, which from varying milk provides for comparison a set of curds of practically the same shape. On this basis, therefore, more satisfactory results are to be expected than even with the German rennet curd test, the superiority of which has already been established. The German investigators consider these similar forms an especial advantage if the milk-tests are to be explained to the producers. In using the Wisconsin curd test officers of the Dairy Division also have for many years found it an advantage to be able to show suppliers the difference between various curds. Emphasis is to be placed upon the similarity between the operations of obtaining the test curd and those which take place in the cheese-vat. Thus the cheesemaker can detect and explain to suppliers those types of milk which will give objectionable curds in the cheese-vat (whether due to the bacteriological or to the chemical condition of the milk). The curd test is of special value for detecting curds which are slimy or which may develop objectionable odours, either in the vat or at some subsequent stage.

It has already been pointed out that no one test alone can be relied upon for eliminating without fail all faulty milks. For this reason the use of the methylene blue test as an adjunct to the curd test has been advocated in New Zealand, with the object of discovering those milks which are heavily contaminated with souring

organisms. Here, too, the experience of officers of the Dairy Division is confirmed by that of the German investigators, who have studied the matter very thoroughly. These investigators made tests of nearly five hundred samples of milk by the reductase test, the reductase-fermentation test, and the reductase-curd test. They found that the presence of the methylene blue does not interfere with the curd test. In the Bumann test or the New Zealand curd test, where the curd is cut to drain the whey, the methylene blue test of course cannot be observed after cutting (about forty-five minutes after renneting). But in the curd test as used by the German scientists the curd remains uncut in the whey till the final examination (twelve hours or more). Some separation of the whey occurs usually after about one and a half to two hours, and renders rather difficult the judging of the time when the blue colour disappears. The difficulty is overcome, however, if the colour of the curd but not of the whey is observed. There can be no doubt that the methylene blue test is a valuable adjunct to the curd test.

The suggestion has been made that the methylene blue test can be easily falsified by adding certain chemicals to the milk. This may be true, but at the same time any farmer who attempted to do this regularly would find it a rather expensive business. The expense and trouble would give much better results if devoted to the heating and use of more boiling water and steam for cleaning the utensils. Experiments have been carried out at the Wallaceville Laboratory with various substances capable of preventing the rapid decolourizing of methylene blue in bad milks. These experiments have shown that even though such milks appear better under the blue test they are usually condemned by the curd test.

Milk-producers who regularly clean their plants well are occasionally tempted to overlook the cleaning after the evening milking. When this has once or twice been done without arousing complaint about the quality of their milk they may do it more often. Sooner or later such producers deliver milk of two qualities—the evening's milk being quite satisfactory, while the morning's milk is the reverse.

This remarkable state of affairs is most likely to happen after a warm night, especially if arrangements have been made to cool the evening's milk quickly and thoroughly. If the machine has not been cleaned the traces of milk left in it enable the germs to multiply enormously during a warm night, and still further rapid multiplication will occur in the warm morning's milk before delivery to the factory. When the condition of the milk is ascertained by means of the curd test, with or without the methylene blue test, such a state of affairs is easily explained and rectified. Experiences like this are a warning that the cooling of milk which is so necessary in warm weather cannot in any way replace thorough cleaning of the machines and utensils.

Officers of the Dairy Division who have had a lengthy experience of the curd test have frequently found it useful in detecting faults in the cleaning of milking-machines and utensils. Here again confirmation comes from the Weiherstephan Experiment Station; in

one case by means of the curd test alone the trouble was traced to dirty cans, and when they were thoroughly washed and steam-sterilized the trouble disappeared. Further investigation disclosed the fact that the cans were infected on the farm by means of the water employed from a spring. This information was also obtained by means of the curd test. For this purpose the diluted rennet used was in one case prepared with the suspected water and for comparison with sterile (boiled) water. Both rennet solutions were used to curdle separate tests upon high-quality milk, and significant differences were obtained pointing to the water as the cause of the trouble. At Weihenstephan a badly cleaned milking-machine was detected by performing curd tests upon the first milk to pass through it and upon the last milk. The first milk gave a bad test, but after a number of cows had been milked the passage of the milk washed away many of the contaminating organisms, so that the last milk gave a much better curd test.

In this and other similar investigations Zeiler and Berwig stated that only the curd test, in agreement with bacteriological findings, signified the presence of an infection, while all other simple tests had allowed the quality of the milk to appear unobjectionable. It is unfortunate that they do not publish their bacteriological findings, as comparatively little information is available in this connection. Where facilities permit it would be interesting and instructive to obtain some comparisons between the results of curd tests and laboratory methods for determining numbers and types of bacteria. On the basis of what is already known about discrepancies between various tests, correlation is to be expected with the majority of milks; in a few cases the curd test will discover faults passed by other methods, and conversely in a few other cases. However, by using the curd test together with other tests, such as the methylene blue, very few faulty milks should be passed.

The German scientists, after using a set of simple milk-quality tests for three years, state that they are so impressed with the value of the curd test that in the fourth year they propose to increase the points allotted to it from ten to fifteen, while no other test is allotted more than five points⁽¹⁰⁾. They regard the test as the best for judging "the suitability of milk for cheesemaking," which, according to their investigations, is the property of milk most difficult to improve.

What has been written suffices to show that the curd test is based upon a firm foundation both generally and particularly. In general the presence of numbers of coliform organisms in milk is evidence of careless handling at some stage; in particular these organisms can very easily cause serious damage and loss to the cheesemaking industry. So long as there are coliform organisms in milk the curd test is never likely to become obsolete. For practical purposes this method of examining milk has undoubtedly stood the test of time, and if conscientiously and regularly used will no doubt help materially to improve both the quality of the milk used for cheesemaking and consequently the quality of cheese exported from New Zealand.

I wish to express my indebtedness to Mr. W. M. Singleton, Director of the Dairy Division, for his assistance in preparing this article. His

criticism and suggestions have been particularly valuable in enabling me to correlate known scientific facts with the observations and experience of practical cheesemakers.

REFERENCES.

- (1) MATTICK, A. T. R. : *Jour. Dairy Res.*, 1, 1930, 133.
- (2) Proceedings of the World's Dairy Congress, 1928, p. 711.
- (3) HAMMER, B. W. : *Dairy Bacteriology*, 1928 (Wiley and Sons), p. 457.
- (4) McGRADY, M. H., and LANGEVIN, E. : *Jour. Dairy Sci.* 15, 1932, 327.
- (5) KENDALL, A. I., and Others : *Jour. Amer. Chem. Soc.* 36, 1914, 1,946.
- (6) WHITEHEAD, H. R. : *Jour. Dairy Res.* 2, 1930, 76.
- (7) BERWIG, A. : *Sudd. Molh.-Zeit.*, May 16, 1929, Nr. 20.
- (8) ZEILER, K., and BERWIG, A. : *Milch. Forsch.*, 10, 1930, 132.
- (9) SINGLETON, W. M. : *N.Z. Jour. Agric.* 44, 1932, 154.
- (10) ZEILER, K., and BERWIG, A. : *Milch. Forsch.*, 10, 1930, 245.

SPREAD OF *PIERIS RAPAE* BUTTERFLY AND PROGRESS OF PARASITE WORK.

J. MUGGERIDGE, Entomologist, Plant Research Station, Palmerston North.

IN the June, 1931, issue of this *Journal* the writer gave an account of *Pieris rapae*, commonly known as the white or cabbage butterfly. It was there mentioned that *Pieris rapae* was first noticed at Napier in 1930, and that in October of the same year it was very plentiful in that locality. In the present article it is intended to refer to the spread of this insect and to give a short account of the progress with the natural enemies introduced.

The 1930-31 season was marked by a rapid increase of the butterfly, so much so that by the end of the season the insect was common in every domestic garden in Napier, Hastings, and the surrounding districts. The 1931-32 season was noteworthy on account of a further increase and spread of the insect. Not only did it increase enormously in the Napier-Hastings area (see shaded portion of map, Fig. 1), being common along the roadsides and fields, but it also spread at least 130 miles from the initial point of infestation. The other places shown on the map represent widely separated localities where the butterfly has been found. They are most likely the farthest points which the butterfly has reached since it first became established at Napier.

When a brief survey of the position was made during the latter part of the past season it was very noticeable that the further one travelled from Hastings on the road south through Dannevirke and towards the Manawatu Gorge, the less prevalent the pest became. Whether the rapid spread of the insect was wholly due to its migratory powers seems questionable; certainly from Hastings to near the Gorge spread was by natural means, but whether in other directions it flew across the intervening ranges or was taken through by human agency is a moot point. It is interesting to note, however, that there were various simultaneous initial points of infestation on the western side of the ranges, suggesting spread by migration. The insect has been noted as far south as Timaru, but as this is the only locality in the South Island from which it has been reported, it is clear that spread in this case was by human agency.

DESTRUCTIVENESS OF *PIERIS RAPAE*.

Although a good deal has been said about the destructiveness of *Pieris rapae* it became clear after surveying the infested area that most of the injury to cruciferous crops was due more to the old enemy diamond-back moth. *Pieris rapae* is conspicuous both in regard to its size and its habits, and on account of this it received more than its fair share of the blame for crop injury. It is, however, very destructive to cabbages and readily attacks both rape and chou moellier. The writer has not had the opportunity yet of observing its attacks on other cruciferous crops.

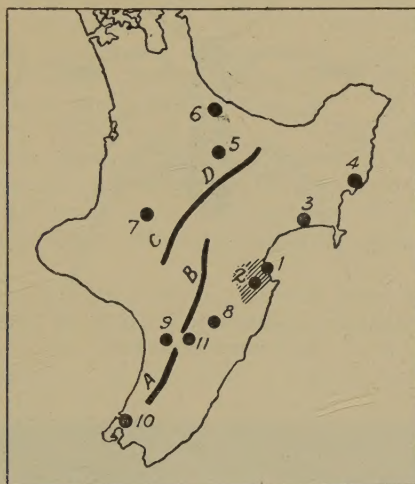


FIG. 1. MAP SHOWING SPREAD OF *PIERIS RAPAE* IN THE NORTH ISLAND.

(1) Napier, (2) Hastings, (3) Wairoa, (4) Gisborne, (5) Waiotapu, (6) Te Puke, (7) Taumarunui, (8) Dannevirke, (9) Palmerston North, (10) Hutt, (11) Manawatu Gorge. A B and C D—Mountain ranges.

PARASITE INTRODUCTIONS.

In the earlier article already referred to mention was made of two important parasites of *P. rapae*—namely, *Pteromalus puparum* and *Apanteles glomeratus* (Fig. 2). In response to requests to the Imperial Institute of Entomology, London, a supply of pupæ of the latter insect was sent out, and the following notes deal with the progress of this work since receipt of the material. Two parasites had emerged when the material was unpacked; the remainder were placed in emergence boxes, and the adults as they emerged from time to time were placed in large test-tubes and fed on raisins for a short period. Mating took place readily under these conditions, and the parasites were then liberated in small cages containing potted cabbage-plants well infested with *P. rapae* larvæ. The most successful method of rearing them under artificial conditions was to confine them as closely as possible with an abundance of the host on its natural food plant. Liberations in a large space, such as an insectary, even in the presence of an abundance of hosts, appeared to be wasteful, as a large number flew to the roof of the insectary and little parasitization took place.

Only the early stage larvæ were parasitized. A female in search of hosts for oviposition was observed to hover near the under side of a leaf where first and second stage caterpillars were situated. Shortly after alighting it was observed palpitating its antennæ on what was apparently a suitable host, as oviposition immediately followed, the ovipositor being inserted in segments of the posterior third of the larva.

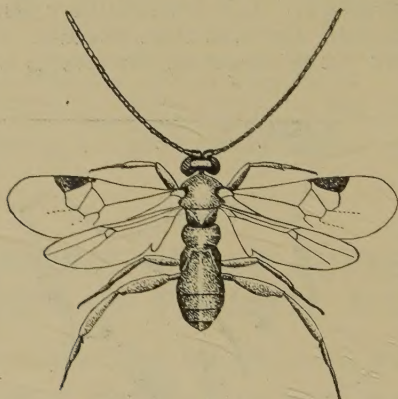


FIG. 2. APANTELES GLOMERATUS, PARASITE OF PIERIS RAPAE.

× 7 APPROXIMATELY.

[Original

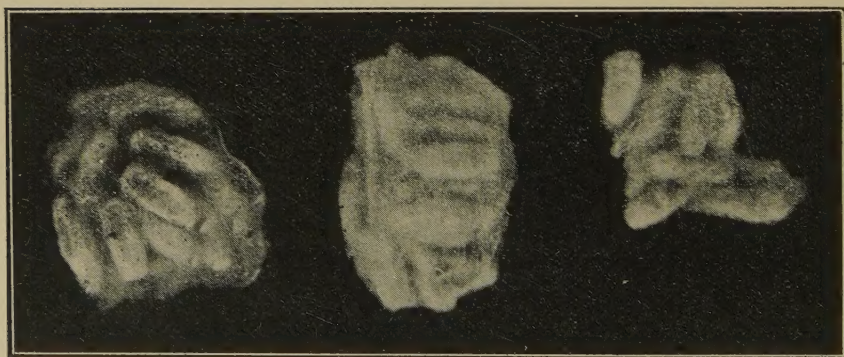


FIG. 3. PARASITE COCOONS. × 3½ APPROXIMATELY.

[Photo by H. Drake.

Very little movement of the host was noted. Older caterpillars resisted attacks by throwing the anterior portion of the body backwards whenever a parasite touched them.

Under glasshouse conditions parasite larvæ emerged from the host from twenty to twenty-eight days following oviposition. The number emerging from one host varied considerably, though there were seldom less than eighteen and occasionally as many as fifty. In the earlier stages there appeared to be no difference between the parasitized and unparasitized larvæ, but in the older caterpillars those parasitized were

readily recognizable owing to their lighter green colour. This condition was most noticeable in the posterior half, where the main proportion of the parasite larvæ completed their development. On close examination the small whitish-coloured parasites could be observed moving beneath the host cuticle.

The emergence of the parasites took place after the host had migrated and settled down in some place suitable for pupation. All parasites within the host apparently completed their development at approximately the same time, as once emergence started they seemed to all leave as fast as possible, protruding themselves from a dozen and more places at once from the unfortunate host, which could live for a short period following parasite emergence but was not observed to pupate. Immediately following emergence the parasites spun their small silken yellow cocoons and settled down to pupate. While each spun its own separate cocoon these rarely occurred singly. On the contrary they were glued together in a bunch (Fig. 3). The habit of *Pieris rapae* in finding some clean place to pupate appeared to favour the parasites, as under these circumstances they were better able to form their cocoons. Should the host fall on to loose dusty ground to pupate the parasites are distinctly handicapped when subsequently emerging to spin their cocoons.

From the 2,500 parasite pupæ received from abroad 1,200 adult parasites emerged. Of these, 870 were used for parasitizing *Pieris rapae* under glasshouse conditions, 270 died in the emergence boxes, and sixty were liberated in the field. Mating had been observed to take place before field liberations were made. Under favourable conditions the adults lived ten to twelve days.

Most of the parasites reared under glasshouse conditions are being held in cold storage for liberation during the present season (1932-33). These will be liberated in only one or two selected localities and will not be available for wide distribution. Should the concentration of the parasites in one or two infested areas in this manner prove successful, and should they become well established in these areas, then a gradual extension of the work would be systematically adopted.

Wheat Certification.—The second annual report of the Wheat Research Institute, recently published, refers to this subject as follows: "The certification of crops of wheat as suitable for seed has been continued by the Department of Agriculture in consultation with the Institute. New standards of purity and freedom from disease have been adopted, and crops are passed for certification only if they contain less than 0.2 per cent. of impurities and less than 0.1 per cent. of loose smut. 3,289 acres were entered for certification, and 385 acres were finally certified. The average quantity sold in past years has been about 15,000 bushels, and there is no doubt that the constant feeding into the market of this quantity of pure seed has been the chief cause of the high standard of purity now found in commercial lines of the common types of Canterbury wheat. Any purchaser of certified seed has the right to apply to have his resultant crop inspected for certification. One recent result of certification has been the very large replacement of College Hunters by College Hunters II—a somewhat superior strain. The original College Hunters had become impure entirely through accidental crossing. It is becoming increasingly obvious that natural crossing will prevent any wheat (except Solid-straw Tuscan) from long continuing pure enough to reach the certification standards, and that the continual supply of new pure strains, now undertaken by the Department of Agriculture at Lincoln, will always be a necessity. The certification of farmers' crops is to be regarded as the final link in the chain of operations for improving the yield and quality of the wheats of the country.

TOMATO LEAF-MOULD (*CLADOSPORIUM FULVUM*).*

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

LEAF-MOULD is one of the most troublesome diseases of glasshouse tomatoes in New Zealand. It is of world-wide distribution, and causes extensive damage to tomato crops throughout Europe and North America. The disease has been present in New Zealand for many years, being first recorded by Kirk in 1897, as causing losses in tomato crops, especially under glass. The disease is confined to tomatoes, and in this country is of economic significance in the glasshouse only.

SYMPTOMS.

Leaf-mould is typically a disease of the foliage, but it may attack the flowers (Makemson, 1919; Small, 1930, *a*) and has been recorded as attacking young tender stems. It appears first as a small downy patch on the under side of the leaf (Fig. 1). Under favourable conditions this rapidly enlarges, and the colour changes to pale buff and finally to a tawny-brown. As the lesion enlarges, the margin advances as a downy white band, while the brown centre assumes a velvety appearance. The development of the lesion on the under side of the leaf is accompanied by the formation of a yellow area on the upper surface. As the disease progresses this yellow area deepens in colour, finally becoming reddish-brown when the leaf tissue is quite dead. With the death of the tissue the lesion on the lower surface often becomes purple in colour. Infection often takes place at a number of points on the leaf, and as the lesions enlarge they coalesce and the whole leaf soon dies and falls off. Occasionally the upper surface of the leaves show scanty growth of the fungus. The lower leaves are usually the first to show infection, and from these the disease gradually spreads upwards.

Flowers are also attacked. Infection of either the calyx or the ovary may occur, and a flower thus attacked fails to develop and falls from the plant (Makemson, 1919; Small, 1930, *a*).

It has been considered by most workers that the disease is confined to the leaves, flowers, and young stems, but Gardner (1925) recorded it as causing a black-rot of the fruit. This form of the disease, however, is unknown in New Zealand.

ECONOMIC IMPORTANCE.

Leaf-mould occurs among glasshouse-grown tomatoes throughout New Zealand. The intensity of attack varies with the seasons, and in some years, especially in the South Island, it is not of economic significance. The extent of the damage depends largely upon the stage of growth of the plants when the attack occurs.

* This is the first of a series of articles covering the tomato diseases present in New Zealand. Each article will deal with a specific disease, and will give particulars of its appearance, cause, and remedial treatment.—Ed.

If the plants become infected while they are still young the greater part of the crop may be lost. This, however, seldom occurs. In New Zealand, glasshouse tomatoes are usually planted in July. The conditions are such that for the first three months there is rarely any infection with leaf-mould. With the occurrence of warm wet weather in November, however, the disease may appear and considerably damage the crop. This may take place when the main portion of the crop is about to ripen, and although the fully grown fruit will develop normally the younger fruit will not develop to full size. Moreover, the flower trusses developing from this time onwards usually fail to set fruit. This may be due either to lack of vitality of the plant brought about by the death of leaves or by the direct attack by the fungus on the flowers. Even in glasshouses where the humidity has been carefully

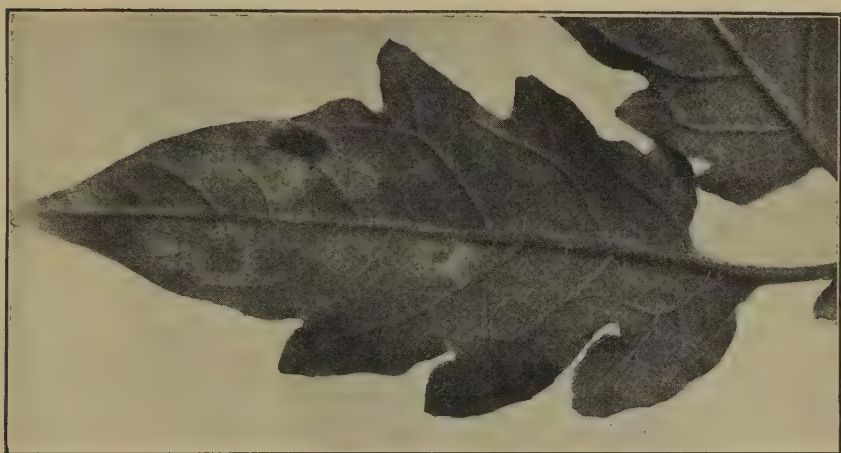


FIG. 1. LEAF-MOULD ON TOMATO LEAF.

Lesions at an early stage of development on the under side of the leaf. The centres of the lesions are just beginning to turn brown.

[Photo by H. Drake.]

controlled it often happens that the disease makes its appearance at the end of the season. An attack at this stage does not interfere with the ripening of the fruit, so the loss is not great.

LIFE HISTORY OF THE CAUSATIVE ORGANISM.

Makemson (1919) proved that tomato leaf-mould was caused by *Cladosporium fulvum* Cke., a member of the Dermatiaceae of the fungi Imperfecti. This has been verified with New Zealand material.

A spore alighting on a leaf will germinate if the temperature and humidity conditions are favourable. The spore may produce one or more germ tubes which develop to form a superficial mycelium, the hyphæ of which are septate and branched. As the fungus spreads over the surface of the leaf the hyphæ enter any leaf stomata with which they come in contact. After gaining entrance through the stomata the fungus rapidly spreads through the

parenchyma and palisade tissue of the leaf, forming a mycelium. The hyphæ, which are still septate and branched, grow in between the cells and also penetrate into them. The mycelium aggregates at the stomata on the lower surface of the leaf, where it forms dense mats of interwoven hyphæ termed stromata. From these stromata arise the fertile hyphæ (conidiophores), which are four to eight septate and carry the spores (Fig. 2). The spores are coloured slightly, are irregular in shape and size, and may be either continuous or one septate. The conidiophores emerge from the stomata in tufts, which are so compacted that they coalesce at the tips to give an appearance of a continuous mat of hyphæ.

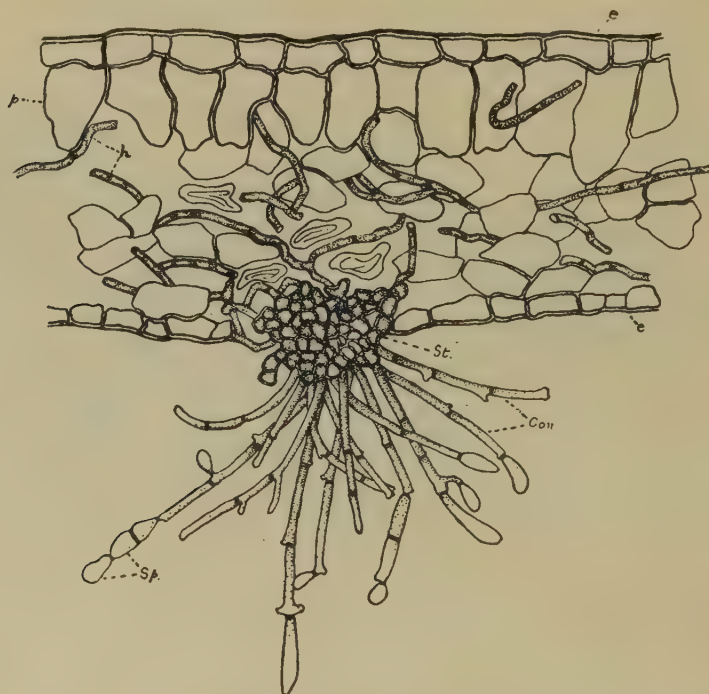


FIG. 2. SECTION THROUGH INFECTED TOMATO LEAFLET $\times 320$.

(Con.) conidiophores; (e) epidermis (cuticle indicated by heavy line); (h) hyphæ; (p) palisade cells; (sp.) conidia (spores); (st.) stroma.

[Original.]

Infection may take place on either the upper or under surface of the leaf, but fructification almost invariably takes place on the under surface. The hyphæ penetrating the leaf tissue obtain nourishment for the production of the fructifications from the plant cells. These cells are soon killed and turn brown. As the fungus spreads, more and more cells die, until the whole leaf is killed and the lower surface completely covered with fructifications. Under favourable conditions infection may be observed six or seven days after a spore has settled on a leaf, and within ten days abundant spore formation may have taken place.

Immense numbers of spores are produced even from a single lesion. They are readily detached from the conidiophores and are carried by air currents from one end of a glasshouse to the other, leading to rapid infection of the whole crop. The spores in a dry condition are capable of remaining viable for at least twelve months. The spores from an infected crop must be harboured in large numbers by the walls and window-sashes of a glasshouse, and it seems probable that these overwintering spores are a source of infection for the following season's crop.

FACTORS AFFECTING INFECTION AND GROWTH OF THE FUNGUS.

The two main factors affecting the infection of tomatoes by leaf-mould are humidity and temperature. Of these humidity has the greater significance. The humidity-temperature relationships have been worked out by Small (1930, *b*) and Van der Meer (1931). Severe infection may occur at 50° to 60° F., provided the humidity is sufficiently high, but at these temperatures the disease develops very slowly. For infection and subsequent development of the fungus humidities above 90 per cent. are very favourable, and the optimum temperature is 72° F. At this temperature infection is severe at 80 per cent. relative humidity and rare at 70 per cent. The lower the temperature the greater must be the relative humidity for infection to occur. A fairly high humidity is also essential for rapid development of the disease, and at 64° F. the growth of the fungus is retarded at 80 per cent. humidity.

From a consideration of these facts it may readily be seen why the disease occurs to such an extent in glasshouses. When a glasshouse is closed down the moisture given off by the growing plants is confined in the house and the relative humidity increases. Further, there is little air movement, so that high local humidity is likely to occur in the vicinity of the actual plants. This is particularly the case when plants are grown close together and possess abundant foliage at their bases. In such cases the relative humidity at the surface of the lower leaves of the plants often approximates 100 per cent. (Guba, 1930), and if high temperatures are prevailing the conditions for infection and development of leaf-mould are ideal. Any movement of the air will result in the replacement of the humid air surrounding the leaves by air having a lower humidity. Consequently air movement plays an important part in keeping down local humidity. The relative insignificance of leaf-mould in the field under New Zealand conditions may be explained by the almost constant air movement tending to decrease the relative humidity in the vicinity of the plants.

When the temperature in a closed glasshouse falls below the point where the air becomes saturated with water vapour the moisture condenses on the glass. This leaves a large surface from which evaporation may take place, so that even when the temperature begins to rise again the air remains nearly saturated for some time. Small (1930, *b*) has shown that low humidity occurring during the day is not sufficient to keep down infection if humid conditions prevail for several hours each night.

Light also has a marked detrimental effect on the fungus in that it retards its growth (Makemson, 1919). This effect may be responsible

in part for the growth of the fungus on the under surface of the leaves, and also for its more ready development on the lower leaves.

The condition of growth of the tomato plants also plays a part in the infection and development of leaf-mould. Excessive watering produces soft succulent plants which are highly susceptible to the disease. This may in part be accounted for by the fact that respiration is greater in these plants, so that a greater local humidity is developed. Also the stomata are much more numerous, with the result that infection takes place more readily. Plants grown in the open have fewer stomata than those grown in the glasshouse.

PREVENTIVE MEASURES.

(a) *Cultural Methods.*—To check infection and development of leaf-mould on tomato plants the humidity should be kept as low as possible, the temperature as much below 72° F. as is practicable, and excessive watering avoided. Both the relative humidity and the temperature may be lowered by adequate ventilation, and the incidence of the disease may be governed by this means. As November approaches, warm weather with humid conditions may be expected, and careful attention should be paid to ventilation. As much ventilation as possible consistent with the maintenance of an even temperature should be given on all occasions. To prevent the temperature from falling too low it is necessary to keep the ventilators closed at night, but an endeavour should be made to open them as early as possible in the morning. Although a maximum of ventilation is advocated a direct draught on to the plants must be avoided, since this may cause chilling of the plants, with the result that the young flower trusses fail to set fruit. Thus care should be taken to open the ventilators on the side of the house away from the wind, and any change of wind should be noted and the ventilators altered accordingly. On hot days it may be necessary to open the doors, in which case, unless the weather is very calm, scrim should be placed over the doorways to prevent a direct current of air through the house. Circulation of air between the plants is aided by a judicious pruning of the leaves at the base of the plant, and by avoiding close planting.

Watering should be carried out early in the day, and as far as possible on fine days only. During dull weather it should be reduced to a minimum and should not be excessive at any time, since too much water produces soft susceptible plants and also tends to raise the humidity. If it is the practice to spray the leaves with water this should be done only on fine days.

Light also plays its part in controlling the disease, and the planting should be carried out so as to allow the maximum amount of light to reach each plant. The above-mentioned pruning of the lower leaves will also aid in allowing light to reach all parts of the plants.

(b) *Spraying.*—There have been many reports that sprays have failed to give control of leaf-mould, and as a result some workers do not recommend their use (Guba, 1929). The usual practice in this country is to spray with bordeaux mixture. It has been shown recently (Small, 1931) that neither bordeaux or burgundy are effective against this disease. Ammonium copper carbonate alone among the copper sprays has been reported as giving good control, but it has been found that under New Zealand conditions this spray causes a certain amount of leaf injury.

Sulphur in its various forms and also sulphur compounds have been found to be particularly toxic to the leaf-mould fungus, and a number of sulphur treatments have been used in attempts to control the disease. Vaporization and dusting with sulphur, and spraying with lime-sulphur, precipitated sulphur, and colloidal sulphur have all been tested (Guba, 1929; Small, 1931). It would appear from the evidence available that of these the colloidal sulphur is the most efficient. Lime-sulphur also appears to have given a good measure of control, but has been found to produce spray injury. If good results are to be obtained with any treatment the latter must be applied immediately on the first appearance of the disease. The reason for this will be readily realized when it is understood that no treatment can directly combat the disease, but can only protect the leaves against further infection. Partial success only will be secured if wrong sprays are used, or spray applications made after the disease has become thoroughly established in the glasshouse.

Growers of glasshouse tomatoes in New Zealand are recommended to spray with sulphur, preferably of the colloidal type. The standard recommendation for strength of colloidal sulphur is 4 lb. of paste per 100 gallons of water. It is possible that under glasshouse conditions this strength is greater than necessary, and that a spray mixture as low as 2 lb. per 100 gallons may be effective against the disease. The time of application of the spray is more significant than its strength. If the disease appears early in the season fortnightly applications are advised, but later in the season the intervals may be extended to three weeks.

DISINFECTION OF EMPTY GLASSHOUSES.

The disease is able to overwinter by means of spores which have lodged in various parts of the glasshouse. Thus a thorough disinfection of the glasshouse before the new season's crop is planted will aid in keeping down infection. Fumigation (Small, 1931; Van der Meer, 1931) has been shown to be the most satisfactory way of disinfecting glasshouses. The two gases which have been found to be consistently effective in killing the spores are formaldehyde and sulphur-dioxide.

Before attempting to fumigate, the glasshouse must be sealed down as completely as possible. To obtain the best results from fumigation the gas should be generated at a number of points. Sufficient formaldehyde gas to fumigate 10,000 cubic ft. of glasshouse space may be generated by adding 2 pints of 40-per-cent. formalin to $1\frac{1}{4}$ lb. of potassium permanganate. Equal portions of the potassium permanganate are added to four deep receptacles placed at different points in the glasshouse and one-quarter of the total formalin poured into each. To fumigate with sulphur-dioxide screened agricultural sulphur is burned at the rate of 10 lb. per 10,000 cubic ft. It is merely spread out in five or six heaps on the floor of the glasshouse and then ignited. The sulphur is readily ignited after pouring a small quantity of methylated spirits on the centre of each heap. At the above concentrations formaldehyde and sulphur dioxide have practically equal efficiency in killing spores of the leaf-mould fungus, while the cost of application of the two treatments is approximately the same.

LITERATURE CITED.

- GARDNER, M. W. (1925): Cladosporium Leaf Mold of Tomato: Fruit Invasion and Seed Transmission. *Jour. Agr. Res.*, Vol. 31, pp. 519-540.
- GUBA, E. F. (1929): Tomato Leaf-mold. The Use of Fungicides for its Control in Greenhouses. *Massachusetts Agric. Exper. Stat. Bull.*, 248, 24 pp.
- GUBA, E. F. (1930): Department of Botany. Ann. Rept. Massachusetts Agric. Exper. Stat., 1929. Bull. 260, pp. 340-344.
- KIRK, T. W. (1897): Leaflets for Gardeners and Fruitgrowers, No. 14, Tomato Diseases. *New Zealand Depart. of Agric. Bull.*, 3 pp.
- MAKEMSON, W. K. (1919): The Leaf Mold of Tomatoes, caused by *Cladosporium fulvum* Cke. *Mich. Acad. Sci. Ann. Rept.* (1918), pp. 311-348.
- MEER, J. H. VAN DER (1931): Maatregelen ter voorkoming eener ernstige aantasting der Tomaten door de schimmel *Cladosporium fulvum* Cke. ("meeldauw"). *Tijdschr. over Plantenziekten*, Vol. 37, pp. 69-90.
- SMALL, T. (1930, a): Tomato Leaf Mould. Fifteenth Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1929, pp. 43-51.
- SMALL, T. (1930, b): The Relation of Atmospheric Temperature and Humidity to Tomato Leaf Mould (*Cladosporium fulvum*). *Ann. Appl. Biol.*, Vol. 17, pp. 71-80.
- SMALL, T. (1931): Experiments on the Control of Tomato Leaf Mould (*Cladosporium fulvum*) by Fungicides and Fumigants. *Ann. Appl. Biol.* Vol. 18, pp. 305-312.

COMMERCIAL FERTILIZERS AND THEIR BASIS OF SALE.

V. INORGANIC NITROGENOUS FERTILIZERS (*concluded*).

J. A. BRUCE, Inspector of Fertilizers, Department of Agriculture, Wellington.

2. By-product Sulphate of Ammonia.

COKING coals containing about $1\frac{1}{2}$ to 2 per cent. of nitrogen are a useful source of by-product sulphate of ammonia, and in certain industries, particularly those which are dependent upon very large quantities of coke or coal for manufactures, it has been a customary practice since the end of last century to recover this fertilizer salt as a main by-product.

The chief sources of supply are city gasworks, coke-ovens, iron and steel works, &c.; comparatively small quantities also are available from the shale and peat industries. For a great number of years the sulphate of ammonia sold in New Zealand was of the by-product type from such above-named sources in Britain, Australia, and the United States of America, and it is only recently that it has been largely replaced by the synthetic sulphate, more especially from the Billingham (England) air-nitrogen factory. In the destructive distillation of coal for the production of illuminating gas, for example, about 22 lb. to 25 lb. of sulphate of ammonia per ton of coal is recoverable during the purification of the gas. An improved method, however, known as the Mond gas process, may be instanced as recovering very much larger quantities. This method consists in blowing in air and steam during the destructive distillation operation, and the sulphate of ammonia recovery is 75 lb. to 85 lb. per ton of coal. In the coke-ovens of the more modern type, using the direct process, the ammonia gas driven off with the other gases in the heating of the coal is passed through dilute solutions of sulphuric

acid, and the sulphate of ammonia is crystallized out. In the older-class of coke-oven plant and in gasworks retorts crude ammoniacal liquor is obtained by literally scrubbing the ammonia gas from the coal with water. The liquor is then treated with lime before being absorbed into sulphuric acid in order to produce the sulphate salt.

By-product sulphate of ammonia has much the same fertilizing-power as the synthetic article; its percentage of water-soluble nitrogen being about 20.6 or 20.8 (461 lb. or 466 lb. per ton). In some cases the synthetic compound may be a trifle more pure and in better physical condition, but, on the whole, the modern product from both sources is of a white crystalline nature, leaving practically no noticeable residue when dissolved in water.* Actually the chemically pure form of sulphate of ammonia contains 21.2 per cent. of nitrogen, so that the margin of difference allowable for moisture and impurities in the commercial article is exceedingly small. Thus the material now on our market can be rated as containing about 98 per cent. sulphate of ammonia.

The difference in colour of consignments of sulphate of ammonia has now and then caused interest, or even suspicion, among purchasers. Formerly it was not unusual to see this salt in the fertilizer-bag either as a grey, yellow, or blue colour, its grey or yellow appearance arising from the presence of a little tarry matter, and the blue colour to a trace of ferro-cyanide. These impurities responsible for the colour variations are present in such minute quantities that the efficiency of the fertilizer could not be impaired in any way.

In the first section of the present article reference was made to the fact that a few grades of by-product sulphate of ammonia may happen to contain certain minor amounts of free sulphuric acid, sufficient to cause serious lumping and bag-rotting. Now under the English fertilizer law the percentage of free sulphuric acid must be declared on the invoice certificate delivered to the purchaser. This is a requirement additional to the statement of the percentage of nitrogen in the case of inorganic nitrogenous products, for which a margin of error of 0.3 per cent. is permitted either above or below the actual figure guaranteed. The New Zealand Fertilizers Act provides a similar limit of variation of 0.5 per cent., but the former provision is not needed here, as our deliveries are from large modern works equipped to make a dry, neutral article with only the very slightest trace (under 0.025 per cent.) of free acid in its composition. There is one point, however, local purchasers might bear in mind in reference to the guarantee of nitrogen. Occasionally this may, for example, be given as 19 per cent. on the invoice certificate, while the bags may carry an inscribed claim of 20.6 or 20.8 per cent. Should this be noticed the matter might well be reported to an Inspector under the Fertilizers Act for investigation.

* The purity of sulphate of ammonia can be tested in another way by heating a little on a shovel at a dull red heat; if any appreciable residue is left the material is not of the requisite purity.

ECONOMIC UTILIZATION OF BY-PRODUCT SULPHATE OF AMMONIA.

Prior to the general development of synthetic nitrogen processes the sulphate of ammonia on the market was of by-product origin, its demand being largely linked up with the demand for coal or coke. It soon became recognized, however, that the by-product supplies from coke-ovens, ironworks, gasworks, &c., would in time be insufficient to cope with the ever-increasing agricultural, industrial, and military demands for nitrogenous compounds, and, like the Chilean nitrate-fields, this source of supply could only be supplementary to the expanding air-nitrogen industry. To-day the latter branch alone is quite capable of economically supplying the world's inorganic nitrogen needs, and in the face of strong competition by-product sulphate of ammonia plants in many instances have experienced very great difficulty in selling their product at anything like a profit. Thus the problem of the more economic employment of the plentiful supplies of crude ammoniacal liquor at large numbers of gasworks has become one of the first magnitude.

It has been suggested to employ this raw liquid by-product on the land direct as a liquid manure, but it is obvious that handling and distribution would be awkward. Notwithstanding the difficulties in this particular direction, a certain amount of anhydrous and aqua ammonia derived from the ammoniacal liquor can be absorbed into superphosphate. Considerable quantities of what is usually termed ammoniated superphosphate are marketed annually in countries, such as the United States, where large quantities of both by-product and synthetic ammonia are available. Later on in this country it may be feasible, as an outcome of the research work now in progress in Britain and elsewhere, to utilize the crude ammoniacal liquor, at present discarded at the various gasworks, for fertilizer manufacture.

3. Nitrate of Soda from Natural Deposits.

The discovery of vast deposits of naturally occurring nitrate of soda in Chile in 1830 marked the beginning of a great industry, which, until the comparatively recent large-scale developments in synthetic nitrogen production took place, dominated the world's nitrogen markets. Although this supremacy is no longer retained, the industry after a century of operation still commands a position of some importance in the international nitrogen field.

The modern operations of mining have been principally confined to five main fields, situated in the exceptionally barren, arid region lying at from 3,000 ft. to 5,000 ft. above sea-level, at the foot of the Andes inland from the coast of Chile. In general character, the beds of nitrate-bearing material, although extensive in both Chile and Peru, are exceedingly patchy and vary greatly in thickness, the average being from 3 ft. to 4 ft. thick and at a depth of less than 2 ft. to 25 ft. or more below the surface. The nitrate ore, composed of a mixture of insoluble clayey or earthy matter, together with certain other soluble salts in addition to the nitrate of soda, bears the name of "caliche." The proportion of nitrate of soda in this may vary from under 10 to 50 per cent., the average approximating to 16 or 17 per cent.

After the caliche is roughly stripped or broken up in the deposit by blasting, it is sorted out and hauled in small trucks drawn by light locomotives to the refining-plants, a large number of which when in use operate what is termed the Shanks process. Here the nitrate is dissolved out with the aid of boiling water in tanks; the salts in solution are first of all separated from the insoluble matter, and then, by means of a chemically controlled system of selective crystallization conducted in large crystallizing tanks, the commercial salt is finally separated in a fairly pure state from the other saline substances in solution and dried. During the purification of the nitrate at the extraction works, valuable iodides and bromides are recovered as secondary products, and it is worthy of mention that a very large proportion of the world's supply of potassium iodide for use in mineral stock foods and licks and for medicinal purposes is taken from the Chilean nitrate. Another preparation of the industry is a concentrated nitrogenous-potassic fertilizer for market-gardens, &c., containing 15 per cent. of nitrogen and 14 to 16 per cent. of pure potash, bearing the trade name of Nitapo.

Most fertilizer users are probably aware that the standard nitrate sold contains a very small proportion of substances or impurities in addition to its actual content of nitrate of soda. The claim of 95 or 96 per cent. purity has no doubt been noticed in trade advertisements. In consequence of possessing 4 or 5 per cent. of these so-called impurities in the form of minor plant-food elements, such as iodine, magnesium, chlorine, &c., of no rated market value, additional to the nitrogen, it has been widely claimed that such accompanying elements have beneficial effect on plant growth. This may be true, but by one of the latest methods adopted for nitrate extraction in Chile—namely, the Guggenheim process, based primarily on a system of refrigeration and undoubtedly a great advance on the older and hitherto more general Shanks process—the so-called impurities are considerably reduced, if not almost entirely eliminated. This is indicated by the following more or less representative composition of the new-processed material: Nitrate of soda, 98.56 per cent. (equivalent approximately to 16.2 per cent. of nitrogen); magnesium chloride, 0.36 per cent.; sodium sulphate, 0.09 per cent.; sodium iodate, 0.07 per cent. (equivalent to 0.045 per cent. of iodine); moisture, 0.82 per cent.; and also traces of sodium carbonate and bi-carbonate, calcium sulphate, and potassium bromate. The older form guaranteed here to contain 15 per cent. of nitrogen—giving a calculated content of only 90 to 91 per cent.* of actual nitrate of soda—can be identified by its greyish or slightly discoloured yellow or pink coarsely crystalline appearance. The new material is in the form of small clear pellets.

From another angle, for the nutrition of crops such as mangels, the element sodium in combination with nitrogen as nitrate of soda has been found in field trials overseas to be of indirect value, just in

* With some the practice in the fertilizer trade is to guarantee (within the limits of error allowed by law) plant-food contents of fertilizers slightly lower than that which may be actually ascertained on analysis. With this class of nitrate the actual average nitrogen content lies nearer 15.5 per cent., equivalent to about 95 per cent. nitrate of soda.

the same way as elemental sulphur in sulphate of ammonia is of use for special soils and crops. There is, furthermore, a possibility that the availability of the potash compounds in some soils may be increased by the sodium when added in the combined state as nitrate of soda.

There does not appear to have been a great amount of nitrate employed in general farming in New Zealand. Supplies on the retail market are mainly purchased in small quantities and used in conjunction with phosphates and potash by market-gardeners, horticulturists, orchardists, and amateur gardeners, the latter most frequently applying the material as a liquid manure. It is noteworthy that thirty-four years ago nitrate of soda (15 per cent. nitrogen guarantee) was sold at Auckland for £15 10s. per ton or £1 0s. 8d. per unit, the same price asked for it to-day. The case of sulphate of ammonia is altogether different, for records in 1908 show that it was being sold in competition with the nitrate in the same city, with a guarantee of 18.9 per cent. of nitrogen, at £17 per ton (cash), or 17s. 11d. per unit, whereas now the product is much more favourably offered at £9 3s. per ton (cash), or 8s. 11d. per unit, for a 20.6 per cent. nitrogen grade. In comparing such unit or commercial values it is only fair to say that their agricultural or field values may give a different interpretation. The unit system of valuation, while of some use no doubt to both sellers and buyers, is not of much avail for measuring the crop-producing power of fertilizers, under widely divergent conditions of soil and climate, in terms of money. To this may be added the fact that any commercial or unit values based on current price-lists in a very short time frequently lose any significance they may appear to have, owing to price fluctuations.

Enormous quantities of refined nitrate have been exported from Chile to Europe and the United States in the past. It would be no exaggeration to say that practically every agricultural country has at some period during the past four or five decades imported the commodity, and to-day its production and agricultural consumption as a nitrogenous fertilizer salt is second only to that of sulphate of ammonia. Vast resources are estimated to be available for exploitation in Chile; authorities variously place the life of the deposits of the crude mineral at from two hundred to three hundred years at normal rates of production.

On more than one occasion of late the nitrate industry has faced a crisis; two years ago a reorganization scheme was embarked upon, and the industry was put under the control of a powerful combine embracing official (Chilean) and private interests principally of an international character, including British, with a capitalization of £75,000,000. The formation of this organization under the name of the *Compañia de Salitre de Chile*, or more briefly "*Cosach*," had for its objectives, *inter alia*, the reduction of costs of production and the centralization of manufacture in large efficient up-to-date (Guggenheim) plants. Further reorganization of this gigantic concern to meet existing and future conditions is reported to be again under consideration.

(Series to be continued.)

WOODLANDS FELICIE—WORLD RECORD JERSEY.

NEW ZEALAND COW'S PERFORMANCE UNDER C.O.R. TEST.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

A NEW world butterfat record for the Jersey breed was created when at Waitara, Taranaki, on 17th August, 1932, Woodlands Felicie concluded her 365 days on Certificate-of-Record test with a total production of 17,332.6 lb. milk containing 1,220.89 lb. butterfat, average test 7.04 per cent. She was 4 years 364 days old at date of calving for start of test, 19th August, 1931, on which day her testing period commenced. Her previous calving date was 12th July, 1930. She is expected to calve subsequent to test on 3rd November, 1932, and, provided she calves not later than the 15th, will qualify for her first-class certificate and be eligible for classification as a C.O.R. cow. Her owner, Mr. P. J. Petersen, states that she has been in calf since 28th January, 1932, and so has carried a calf for 202 days of her 365-day testing period. She was milked three times daily throughout the entire period of test.

The highest previous authenticated yield for the Jersey breed was 1,197.51 lb. fat from 23,677 lb. milk, average test 5.06 per cent., this being the performance of the United States cow Abigail of Hillside on a record commenced at the age of 8 years 6 months. So far as our information goes, Abigail would not have qualified under the New Zealand C.O.R. rules relative to calving. Further, she was actually on test for thirteen months, and in computing her record the first month's production was discarded in favour of her yield for the thirteenth month, which was greater than that of the first thirty days. This procedure would not have been permitted in New Zealand, our rules providing that the test shall be for a maximum of 365 days commencing not later than the day after calving. Abigail's milk yield, however, remains considerably in excess of any other cow of the breed. In comparing the records of the two cows, the outstanding feature lies in the remarkable difference in average test, which was 5.06 for Abigail and 7.04 for Felicie, the average test for Jerseys throughout the world having remained practically constant for many years at approximately 5.5 per cent.

As butterfat champion of New Zealand for all breeds Woodlands Felicie displaces the Friesian cow Alcartra Clothilde Pietje, who during the 1921-22 season gained a C.O.R. for 1,145.24 lb. butterfat, on a test commenced at the age of 7 years 357 days.

Our records are not sufficiently complete to enable us to say with certainty where Woodlands Felicie stands among the leading butterfat producers of the British Empire, but cows which come to mind are the Australian Milking Shorthorn Melba XV of Darlbalara, whose phenomenal yield of 1,614.1 lb. butterfat places her far ahead of any other cow of any breed; De Kol Plus Segis Dixie, the Canadian Friesian, with 1,349.31 lb. butterfat; Agassiz Segis May Echo, Canadian Friesian, with 1,345 lb.; Bella Pontiac, another Canadian Friesian, with 1,270 lb.; Nellie Osborne of Elm Shade 16th,

Canadian Ayrshire, with 1,257.20 lb.; and Manor Keyes Bettina, Canadian Friesian, who in March, 1926, commenced test at 4 years 325 days old (the same age class as Woodlands Felicie) and produced 32,652 lb. milk containing 1,251 lb. butterfat, being milked four times daily.

Woodlands Felicie was bred by Mr. H. C. Sampson, of Hillsborough, Taranaki, and was first tested by Mr. Petersen as a junior two-year-old, when, commencing at 2 years 10 days of age, she gained a first-class C.O.R. for 8,265.6 lb. milk and 550.54 lb. butterfat in 365 days, with an average test of 6.66 per cent.

The sire of Woodlands Felicie is Bright Sultan, an imported bull bred by Messrs. B. H. Bull and Son, Ontario, Canada, and who,



WOODLANDS FELICIE.

[*"Exporter" photo.*]

on the sire's side, traces twice to Eminent, imported from Jersey Island and said to be one of the outstanding bulls of the breed. Bright Sultan has seventeen C.O.R. daughters. The dam of Woodlands Felicie is Woodlands Felicity, C.O.R. 671 lb. butterfat, who is by Mercedes Golden Laddie (eight C.O.R. daughters), who in turn is by Viola's Golden Laddie, champion butterfat bull with twenty-eight C.O.R. daughters, and imported from the well-known Linden Grove stud of the late Mr. T. S. Cooper, Pennsylvania. On what may be termed the New Zealand side of Woodlands Felicie's pedigree there are many noted animals, and scarcely a name which is not linked up with quality from a production point of view. Some of the more outstanding among the males are K.C.B. (though he was an imported bull), Stevenson, Pride of Egmont, and Jersey

Boy, and, among the females, Grannie, Mercedes Lady, Zephyr, and Zenith. Reviewed over a period of eight generations the pedigree of Woodlands Felicie shows little evidence of systematic breeding, its interest lying principally in the large number of breeders and strains represented.

The performance of Woodlands Felicie was very carefully supervised by the Dairy Division. Some fifteen testing visits were paid to the farm, and three different testing officers took part in checking the cow's yield. Particulars of her performance month by month are as follows:—

Month.			Days.	Milk.	Test.	Butterfat.
				lb.	Per cent.	lb.
August, 1931	..	..	13	414·7	7·03	29·15
September	..	..	30	1,573·5	6·19	97·39
October	..	..	31	1,714·2	5·84	100·10
November	..	..	30	1,652·8	6·67	110·24
December	..	..	31	1,602·1	6·69	107·18
January, 1932	..	..	31	1,579·6	7·11	112·30
February	..	..	29	1,403·1	7·14	100·18
March	..	..	31	1,355·3	7·18	97·31
April	..	..	30	1,342·8	7·31	98·15
May	..	..	31	1,440·7	7·66	110·35
June	..	..	30	1,235·1	8·11	100·16
July	..	..	31	1,323·0	7·87	104·12
August	..	..	17	695·7	7·80	54·26
Totals	..	..	365	17,332·6	7·04*	1,220·89

* Average.

We are not permitted to publish details of the food ration of Woodlands Felicie, but may say that strict attention was devoted to this phase of the supervision, and that in relation to her yield the cow received surprisingly little by way of special feed. She had, however, the advantage of excellent pasture and skilful handling, and is a cow of extremely placid disposition. At the close of her test Felicie was still yielding at the rate of over 40 lb. of milk per day, and she appears to show no sign of strain.

Detection of Abortion Disease in Dairy Herds.—Abortion in cows is caused by a germ. The afterbirth and discharge from an aborting cow spread the germs on the ground, from which they reach other cows through ingestion of the contaminated pasture. Animals affected with abortion disease can be diagnosed by the Wallaceville Veterinary Laboratory by means of a blood examination. All that the farmer has to do is to send blood in a $\frac{1}{2}$ oz. bottle for testing. The blood should be collected from a cut in the end of the cow's tail. Abortion disease causes loss in the milk-supply, loss of calves, sterility in cows, and is also a source of danger to human beings. Therefore affected cows in a herd should be known. The blood-test is carried out by the Laboratory free of charge. The blood-test is known as the agglutination test. By its use affected cows in a herd can be segregated at calving time, thus preventing the spread of the disease. Departmental officers will advise any farmer interested in the methods of control of abortion disease, and farmers are well advised to avail themselves of this departmental service.

PASTURE TOP-DRESSING IN MARLBOROUGH.

EXPERIMENTAL WORK BY THE FIELDS DIVISION, PERIOD
1929 TO 1932.

R. MCGILLIVRAY, Fields Superintendent, Christchurch, and A. G. ELLIOTT,
Instructor in Agriculture, Blenheim.

A LARGE part of the Province of Marlborough consists of tussock grasslands occupied as sheep-runs. The total area of the province is 2,768,000 acres, of which the occupied area amounts to 2,482,754 acres. There are 1,925 holdings in the four counties into which the province is divided, and the average size of holding is 1,289 acres. An area of approximately 30,000 acres is in grain, pulse, root, and green crops, and of this area approximately 3,600 acres are in wheat. These figures clearly indicate the importance of the grassland farming carried on in the province. In certain districts dairy-farming is in operation, and where climatic conditions are favourable and pasture-improvement work has been undertaken this type of farming is successful, and there are now over 16,000 dairy cows within the boundaries of Marlborough Province.

Some Marlborough farmers have been top-dressing their pasture for a considerable number of years, but it is only of comparatively recent times that any forward move has been made, and even to-day there are only about 23,062 acres top-dressed. With the exception of the fertilizers applied to 3,000 acres, practically all the top-dressing has been done with superphosphate. Statistics show that under 1,000 acres have been limed. Experimental results show that an extension of liming is desirable, as in practically all experiments the combination of lime and superphosphate shows a much better response than superphosphate alone, and in grazing a preference is shown by stock for the pasturage on the lime-superphosphate plots.

In order to obtain some definite information in connection with manurial response in the various districts, thirty-two observational top-dressing experiments were laid down in the 1929 season, and in 1930 a further ten experiments of a slightly different layout were put down. In all these experiments lime, superphosphate, potash, and nitrogen were used, and this article presents the results obtained from the individual plots.

The responses-to-manure survey carried out per medium of this series of experiments has shown that any endeavour to permanently improve pastures by manurial treatment must be preceded by the sowing of improved strains of pasture plants if a full measure of success is to be obtained. This factor, fortunately, is now being attended to, and there is a good demand for certified seeds. The poor strains of pasture plants may in the early stages of development show satisfactory results from top-dressing, but in practically all cases their period of usefulness is short, while the good types are persistent in growth and highly productive.

The question of management and utilization of pastures has been taken up in connection with top-dressing operations, and the importance of management is now being generally acknowledged, but this cannot

be fully developed until a much larger area is sown with pasture mixtures containing elements of longevity and at the same time of high productive capacity.

The plots laid down were treated as follows:—

- (1) Carbonate of lime 1 ton per acre.
- (2) Superphosphate 3 cwt. per acre.
- (3) 30 per cent. potash salts .. 2 cwt. per acre.
- (4) Sulphate of ammonia .. 1 cwt. per acre at each application.

The initial dressings were applied during the winter of 1929. No further applications of lime were made, but superphosphate and 30 per cent. potash salts were each applied at the rate of 2 cwt. each season subsequent to the first, and there was a spring and autumn application of sulphate of ammonia at the rate of 1 cwt. per acre at each application.

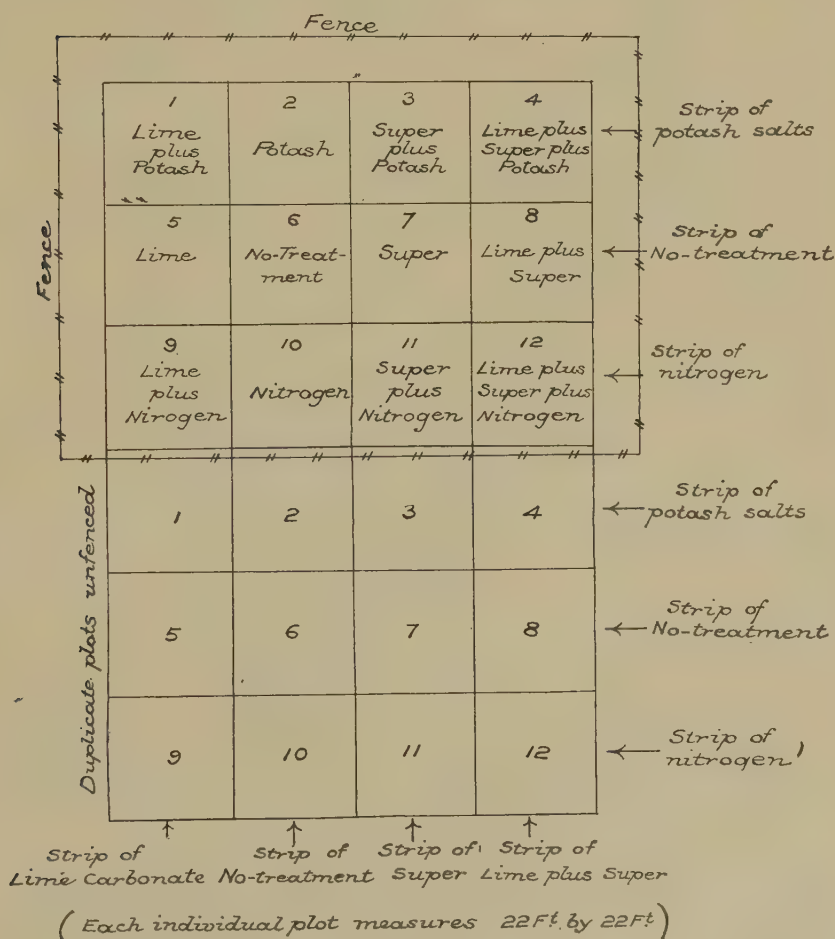


FIG. 1. PLAN OF STANDARD EXPERIMENT ADOPTED FOR THE SURVEY.

DISTRIBUTION OF EXPERIMENTS AND MANAGEMENT.

The co-operation of branches of the Farmers' Union was invited in the selection of areas on which plots were established, and the scheme for laying down those in 1929 was the same as that adopted in Canterbury (see this *Journal* for October, 1930, page 249, and November, 1930, page 326), as shown in Fig. 1. This provided for the intensive grazing and spelling of half the area, which was fenced off, while the remaining duplicate plots received the same treatment as did the rest of the paddock. It soon became evident, however, that, in the dairying districts at least, it was practically impossible to make full use of the flush of feed in the fenced portion, so that during the next year the whole area top-dressed was grazed with the remainder of the field.

In 1930, plots to the number of ten were laid down under a modified plan in the Seddon, Ward, and Kaikoura districts, thus completing the chain. The position of each experiment is indicated on the map by a dot, and the numbers correspond to those used in Table 2.

INTERPRETATION OF RESULTS AS RECORDED IN TABLES 1 AND 2.

In order to indicate as briefly as possible the nature of the effect of lime or manures applied, the following points are awarded: 0 = no visible response; ? = doubtful response; 1 = slight response; 2 = fair response; 3 = good response; 4 = very good response; 5 = excellent response.

In some cases responses to both lime and super individually may be classed as "good" (3 points each), and the response to the combined lime plus super as "very good" or "excellent" (4 or 5 points). In such cases the combined effect of lime plus super may be regarded as practically equal to the sum of the effects of the individual treatments. Points awarded to potash and nitrogen may be regarded as representing their response in conjunction with super or lime plus super.

In Table 1 the responses coming in the various classes mentioned above are presented as percentages of the total number of trials. In Table 2 the responses in the individual trials are shown grouped in districts.

Table 1.—Percentages of Total Number of Experiments which fall in various Response Classes so far as Response to main Treatments is concerned.

Treatment.	Degree of Response to Treatment.							Total Number of Experiments in which Treatment used.
	None Visible (0).	Doubtful (?).	Slight (1).	Fair (2).	Good (3).	Very Good (4).	Excellent (5).	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Lime	..	4.8	36.0	31.2	24.0	2.4	..	42
Super	..	..	4.8	33.6	43.2	19.2	..	42
Lime plus super	..	..	..	4.8	36.0	43.2	16.8	42
Potash	93.6	7.2	..	..	..	..	..	42
Nitrogen	..	..	2.4	48.0	48.0	2.4	..	42

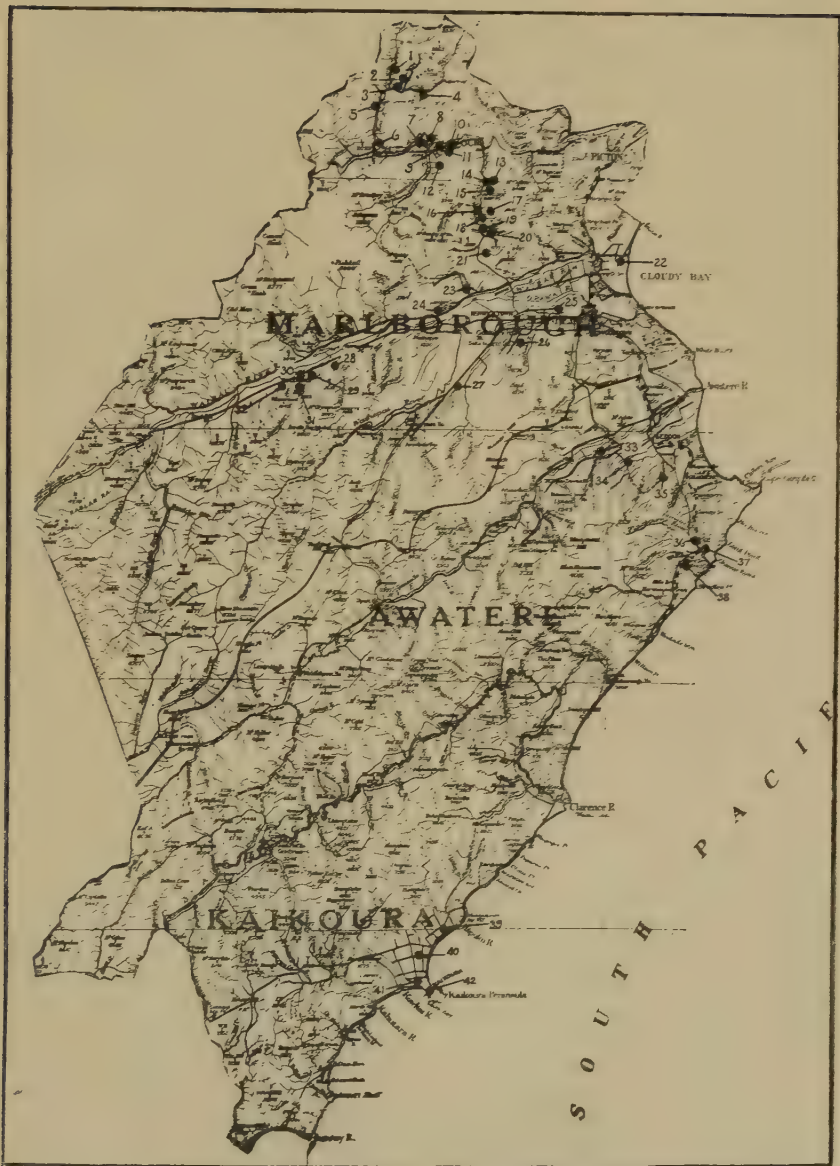


FIG. 2. MAP SHOWING LOCATION OF THE TOP-DRESSING EXPERIMENTS IN MARLBOROUGH PROVINCE (see Table 2).

GENERAL COMMENTS ON RESPONSES TO TREATMENTS: TABLE I.

Lime.—About 95 per cent. of the trials gave "slight" to "very good" responses to lime alone, the majority of these, 36 per cent. and 31 per cent., being in the "slight" and "fair" response classes respectively. In the heavier rainfall districts, through the Okaramio

Only the early stage larvæ were parasitized. A female in search of hosts for oviposition was observed to hover near the under side of a leaf where first and second stage caterpillars were situated. Shortly after alighting it was observed palpitating its antennæ on what was apparently a suitable host, as oviposition immediately followed, the ovipositor being inserted in segments of the posterior third of the larva.



FIG. 2. APANTELES GLOMERATUS, PARASITE OF PIERIS RAPAE.

× 7 APPROXIMATELY.

[Original

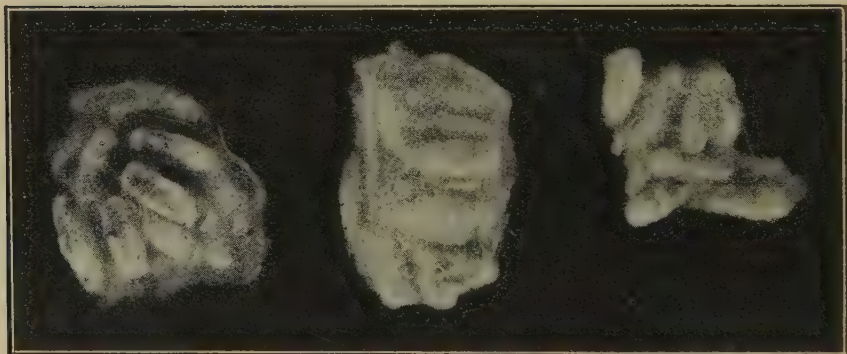


FIG. 3. PARASITE COCOONS. × 3½ APPROXIMATELY.

[Photo by H. Drake.

Very little movement of the host was noted. Older caterpillars resisted attacks by throwing the anterior portion of the body backwards whenever a parasite touched them.

Under glasshouse conditions parasite larvæ emerged from the host from twenty to twenty-eight days following oviposition. The number emerging from one host varied considerably, though there were seldom less than eighteen and occasionally as many as fifty. In the earlier stages there appeared to be no difference between the parasitized and unparasitized larvæ, but in the older caterpillars those parasitized were

readily recognizable owing to their lighter green colour. This condition was most noticeable in the posterior half, where the main proportion of the parasite larvæ completed their development. On close examination the small whitish-coloured parasites could be observed moving beneath the host cuticle.

The emergence of the parasites took place after the host had migrated and settled down in some place suitable for pupation. All parasites within the host apparently completed their development at approximately the same time, as once emergence started they seemed to all leave as fast as possible, protruding themselves from a dozen and more places at once from the unfortunate host, which could live for a short period following parasite emergence but was not observed to pupate. Immediately following emergence the parasites spun their small silken yellow cocoons and settled down to pupate. While each spun its own separate cocoon these rarely occurred singly. On the contrary they were glued together in a bunch (Fig. 3). The habit of *Pieris rapae* in finding some clean place to pupate appeared to favour the parasites, as under these circumstances they were better able to form their cocoons. Should the host fall on to loose dusty ground to pupate the parasites are distinctly handicapped when subsequently emerging to spin their cocoons.

From the 2,500 parasite pupæ received from abroad 1,200 adult parasites emerged. Of these, 870 were used for parasitizing *Pieris rapae* under glasshouse conditions, 270 died in the emergence boxes, and sixty were liberated in the field. Mating had been observed to take place before field liberations were made. Under favourable conditions the adults lived ten to twelve days.

Most of the parasites reared under glasshouse conditions are being held in cold storage for liberation during the present season (1932-33). These will be liberated in only one or two selected localities and will not be available for wide distribution. Should the concentration of the parasites in one or two infested areas in this manner prove successful, and should they become well established in these areas, then a gradual extension of the work would be systematically adopted.

Wheat Certification.—The second annual report of the Wheat Research Institute, recently published, refers to this subject as follows: "The certification of crops of wheat as suitable for seed has been continued by the Department of Agriculture in consultation with the Institute. New standards of purity and freedom from disease have been adopted, and crops are passed for certification only if they contain less than 0.2 per cent. of impurities and less than 0.1 per cent. of loose smut. 3,289 acres were entered for certification, and 385 acres were finally certified. The average quantity sold in past years has been about 15,000 bushels, and there is no doubt that the constant feeding into the market of this quantity of pure seed has been the chief cause of the high standard of purity now found in commercial lines of the common types of Canterbury wheat. Any purchaser of certified seed has the right to apply to have his resultant crop inspected for certification. One recent result of certification has been the very large replacement of College Hunters by College Hunters II—a somewhat superior strain. The original College Hunters had become impure entirely through accidental crossing. It is becoming increasingly obvious that natural crossing will prevent any wheat (except Solid-straw Tuscan) from long continuing pure enough to reach the certification standards, and that the continual supply of new pure strains, now undertaken by the Department of Agriculture at Lincoln, will always be a necessity. The certification of farmers' crops is to be regarded as the final link in the chain of operations for improving the yield and quality of the wheats of the country.

TOMATO LEAF-MOULD (*CLADOSPORIUM FULVUM*).*

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

LEAF-MOULD is one of the most troublesome diseases of glasshouse tomatoes in New Zealand. It is of world-wide distribution, and causes extensive damage to tomato crops throughout Europe and North America. The disease has been present in New Zealand for many years, being first recorded by Kirk in 1897, as causing losses in tomato crops, especially under glass. The disease is confined to tomatoes, and in this country is of economic significance in the glasshouse only.

SYMPTOMS.

Leaf-mould is typically a disease of the foliage, but it may attack the flowers (Makemson, 1919; Small, 1930, *a*) and has been recorded as attacking young tender stems. It appears first as a small downy patch on the under side of the leaf (Fig. 1). Under favourable conditions this rapidly enlarges, and the colour changes to pale buff and finally to a tawny-brown. As the lesion enlarges, the margin advances as a downy white band, while the brown centre assumes a velvety appearance. The development of the lesion on the under side of the leaf is accompanied by the formation of a yellow area on the upper surface. As the disease progresses this yellow area deepens in colour, finally becoming reddish-brown when the leaf tissue is quite dead. With the death of the tissue the lesion on the lower surface often becomes purple in colour. Infection often takes place at a number of points on the leaf, and as the lesions enlarge they coalesce and the whole leaf soon dies and falls off. Occasionally the upper surface of the leaves show scanty growth of the fungus. The lower leaves are usually the first to show infection, and from these the disease gradually spreads upwards.

Flowers are also attacked. Infection of either the calyx or the ovary may occur, and a flower thus attacked fails to develop and falls from the plant (Makemson, 1919; Small, 1930, *a*).

It has been considered by most workers that the disease is confined to the leaves, flowers, and young stems, but Gardner (1925) recorded it as causing a black-rot of the fruit. This form of the disease, however, is unknown in New Zealand.

ECONOMIC IMPORTANCE.

Leaf-mould occurs among glasshouse-grown tomatoes throughout New Zealand. The intensity of attack varies with the seasons, and in some years, especially in the South Island, it is not of economic significance. The extent of the damage depends largely upon the stage of growth of the plants when the attack occurs.

* This is the first of a series of articles covering the tomato diseases present in New Zealand. Each article will deal with a specific disease, and will give particulars of its appearance, cause, and remedial treatment.—Ed.

If the plants become infected while they are still young the greater part of the crop may be lost. This, however, seldom occurs. In New Zealand, glasshouse tomatoes are usually planted in July. The conditions are such that for the first three months there is rarely any infection with leaf-mould. With the occurrence of warm wet weather in November, however, the disease may appear and considerably damage the crop. This may take place when the main portion of the crop is about to ripen, and although the fully grown fruit will develop normally the younger fruit will not develop to full size. Moreover, the flower trusses developing from this time onwards usually fail to set fruit. This may be due either to lack of vitality of the plant brought about by the death of leaves or by the direct attack by the fungus on the flowers. Even in glasshouses where the humidity has been carefully

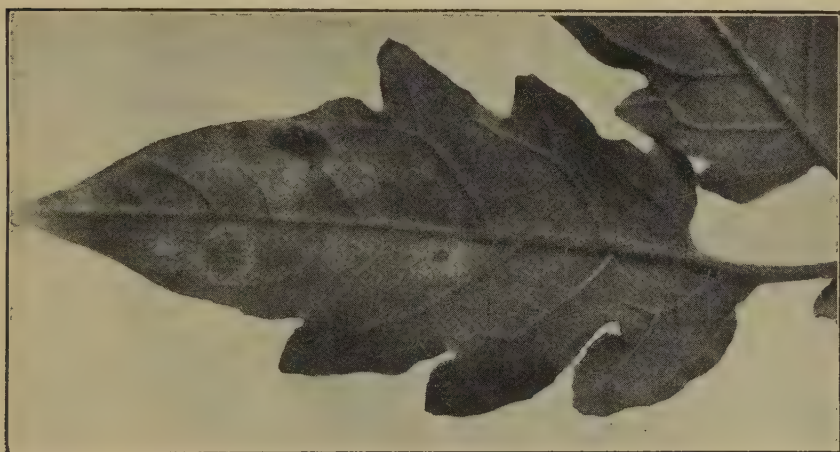


FIG. I. LEAF-MOULD ON TOMATO LEAF.

Lesions at an early stage of development on the under side of the leaf. The centres of the lesions are just beginning to turn brown.

[Photo by H. Drake.]

controlled it often happens that the disease makes its appearance at the end of the season. An attack at this stage does not interfere with the ripening of the fruit, so the loss is not great.

LIFE HISTORY OF THE CAUSATIVE ORGANISM.

Makemson (1919) proved that tomato leaf-mould was caused by *Cladosporium fulvum* Cke., a member of the Dermatiaceae of the fungi Imperfecti. This has been verified with New Zealand material.

A spore alighting on a leaf will germinate if the temperature and humidity conditions are favourable. The spore may produce one or more germ tubes which develop to form a superficial mycelium, the hyphæ of which are septate and branched. As the fungus spreads over the surface of the leaf the hyphæ enter any leaf stomata with which they come in contact. After gaining entrance through the stomata the fungus rapidly spreads through the

of this area has undoubtedly greatly influenced local top-dressing practice. Annual rainfall 45 in.

SUMMARY.

During 1929 and 1930 forty-two observational experiments on top-dressing of pasture were laid down in Marlborough Province with the object of determining what observable response would result from the application of carbonate of lime, superphosphate, 30-per-cent. potash salts, and nitrogen in the form of sulphate of ammonia.

(1) The outstanding features of the trial were: (a) A general response from lime and super, especially where these treatments were combined; (b) a comparative absence of observable effects from the use of potash; (c) a general response from the use of sulphate of ammonia.

(2) The need for greater use of better and more persistent strains of certified pasture plants, and better utilization of growth, if full benefits from the use of lime and fertilizers are to be obtained, has been stressed.

(3) With the possible exception of the drier districts represented by Ward and Seddon, the use of lime and superphosphate in conjunction with one another must be regarded as a paying proposition on reasonably good pastures.

(4) So far as can be judged by observation the use of potash is not warranted.

(5) The general use of nitrogen cannot be regarded as being worth while, except where early spring or late autumn feed is particularly desired (and then only on pastures which are reasonably good in the better grasses) or for the production of grass-seed crops. It is viewed as essential that its use should be accompanied by that of lime and superphosphate.

The writers wish to acknowledge the assistance given by farmers in placing fields at the disposal of the Department for the purpose of the trials herein reported upon. Thanks are also due to the various Farmers' Union branches and agricultural and pastoral societies for their general assistance and co-operation in connection with the carrying out of arrangements for experimental areas in the various districts.

LIMONITE FOR CONTROL OF BUSH SICKNESS.

FARMERS' EXPERIENCES IN AFFECTED DISTRICT.

AN interesting report from Mr. H. R. Pearson, honorary secretary of the Tokoroa Progress League, was received recently, with a suggestion that it might be published in the *Journal*. The report embodies the local farmers' own opinion of the use of limonite in the farming of a large area of land which is only slightly bush-sick, and constitutes a good record of experience with this recently introduced remedy. After some remarks on the properties of limonite and its advantages, Mr. Pearson states:—

Limonite was introduced into the Tokoroa district in January of this year, and during the last six months the Tokoroa Progress League has kept in touch with settlers who are using the lick. In several cases accurate

records were kept, and the League is able to report a number of instances where splendid results have been obtained.

One of the most interesting cases that came under the notice of the league was that of a herd of cows owned by Mr. M. S. Mathiasen, of Tokoroa. Mr. Mathiasen's herd was not in the best of condition, and several cows were showing signs of sickness. The peak of production was reached in December, and in the first period of January a considerable falling-off was shown. The limonite lick was given to the herd about the middle of January, and the milk production rose continuously right through January and February. For the first period in March the production was higher than for the corresponding period in January, but by that time the autumn conditions were making themselves felt and production began to fall. The butterfat statements from the factory were shown to the writer, and the figures are as follows: December, 1,011 lb.; January, 956 lb.; February, 1,075 lb.; March, 984 lb. It will be noticed that the total production for March is very little behind that of December, the peak month before the use of limonite.

In the 1930-31 season Mr. Mathiasen reared twenty-four calves, which did very well till they were weaned. Then they began to waste away and all had died before the spring of 1931. This past season only twelve calves were reared, and in January they began to show the usual signs of sickness. They were given the lick towards the end of that month, and showed an immediate improvement. Now, at the end of May, the twelve calves are in fine condition, and will make a valuable addition to the herd in years to come.

Another Tokoroa settler, Mr. R. D. Thomson, had one very sick cow in his herd, and decided to drench this cow with limonite, and check up definitely on the improvement in milk yield. The cow was milked by hand in the evenings, and at the beginning of the test gave 3 lb. of milk at the evening milking. The cow was drenched daily, the dose being half-a-tablespoonful of limonite in a pint of water. On the evening of the tenth day the milk yield had risen to 10 lb., and the cow was in much better health. All the cows had access to the usual limonite lick, and Mr. Thomson reports a decided improvement in the health of the herd since the lick was first made available to them.

Mr. L. A. Newell also gives interesting testimony to the value of limonite, and as his herd is under test the figures can be taken as accurate. Up to January, Mr. Newell's herd averaged 4 lb. of butterfat per cow less than for the same period of the previous year. Since January the cows have been given limonite, and have milked so well as to bring the average for the year up to within 1.37 lb. of butterfat per cow of the previous year's figure. It is obvious that the cows have milked wonderfully well during the autumn, and Mr. Newell is confident that limonite was responsible for this very satisfactory result.

The writer has before him a letter from Mr. Newell, and one paragraph is of particular interest. He says, "I have twenty Jersey cross heifers doing very well. The last three years I have lost most of my calves, but this year, on limonite, they are showing no signs of sickness."

Mr. Campbell reports the case of a young bull that was turned out on a distant part of the property. The bull became sick and was so feeble that he got down and was lying in the paddock for several days before he was found by a shepherd. He was then urged to his feet, and was driven with great difficulty to the homestead, where he was put in a paddock where limonite was available. Three weeks later the bull was fit and well.

Another settler had a similar experience with a lamb that found its way to the back of the farm where no lick was available. The lamb became so sick that it had to be carried back to the house. It was given the lick, which it took greedily, and a few weeks later it had completely recovered and was in fine condition.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR YEAR 1931.

N. R. Foy, Seed Analyst, Plant Research Station, Palmerston North.

For the calendar year 1931 11,766 seed-samples were tested at the Department of Agriculture's Seed-testing Station at Palmerston North, this representing an increase of 1,305 samples on the number received during the previous year.

Table 1.—Origin of Samples received, 1931 and 1930.

Senders, &c.	Number of Samples.	
	1931.	1930.
Seed-merchants	9,236	8,856
Farmers and seed-growers	238	190
Government Departments (other than Agriculture)	224	130
Massey Agricultural College	..	247
Agriculture Department—		
Fields Division	262	141
Plant Research Station	824	642
Retests	96	255
Ultra-violet light tests	886	..
Totals	11,766	10,461

Table 2.—Number of Samples received each Month, 1931 and 1930.

Month.	Number.		Month.	Number.	
	1931.	1930.		1931.	1930.
January	702	578	July	1,303	932
February	652	773	August	1,208	1,119
March	1,086	1,251	September	1,260	1,181
April	805	807	October	896	847
May	1,030	1,276	November	753	483
June	1,256	831	December	815	303

Table 3.—Classification and Numbers of Samples and Tests, 1931 and 1930.

Classification.	Number.	
	1931.	1930.
Samples for purity and germination	4,377	3,889
Samples for purity only	197	133
Samples for germination only	6,292	6,439
Purity tests made	4,574	4,022
Germination tests made	10,669	10,328
Ultra-violet light tests	886	..
Total tests made	16,129	14,350

The accompanying tables, 1, 2, 3, 4, and 5, show the distribution, origin, classification, &c., of the various samples. Of the samples shown for the Plant Research Station, about one-half represent Seed-testing Station tests, and the remainder samples received from the Mycologist, Agrostologist, Agronomist, &c., in connection with their various activities.

Table 4.—Number of Samples from Land Districts and Centres therein, 1931 and 1930.

Land District, &c.	1931.	1930.	Land District, &c.	1931.	1930.
Southland (total) ..	2,712	2,721	Otago (total) ..	898	924
Gore ..	1,592	1,392	Dunedin ..	810	860
Invercargill ..	1,094	1,326	Other ..	88	64
Other ..	26	3	Hawke's Bay ..	613	700
Wellington (total) ..	2,078	1,671	Taranaki ..	402	416
City ..	842	649	Marlborough ..	228	184
Palmerston North and Feilding ..	1,027	790	Gisborne ..	101	24
Other ..	209	232	Nelson ..	4	..
Canterbury (total) ..	1,264	1,117	North Auckland ..	1	..
Christchurch ..	722	581	Overseas ..	28	57
Other ..	542	536			
Auckland (total) ..	930	1,042			
City ..	848	934			
Other ..	82	108			

Table 5.—Number of Samples of Various Seed Species reported on in 1931 and 1930, and Number of Tests made thereon in 1931 (excluding Special Station Tests).

Species.	1931.			1930.
	Purity Tests.	Germination Tests.	Samples.	Samples.
<i>Grasses.</i>				
Perennial rye-grass (<i>Lolium perenne</i>) ..	686	2,385	2,394	2,272
Italian rye-grass (<i>Lolium multiflorum</i>) ..	81	247	249	324
Western Wolths rye-grass (<i>Lolium westwoldicum</i>) ..	24	150	150	184
Cocksfoot (<i>Dactylis glomerata</i>) ..	197	402	411	442
Crested dogtail (<i>Cynosurus cristatus</i>) ..	572	779	802	897
Chewings fescue (<i>Festuca rubra</i> var. <i>fallax</i>) ..	765	888	906	1,035
Brown-top (<i>Agrostis tenuis</i>) ..	464	449	464	852
Danthonia pilosa ..	8	27	27	45
Timothy (<i>Phleum pratense</i>) ..	43	80	81	97
Fog (<i>Holcus lanatus</i>) ..	48	49	53	38
Meadow-fescue (<i>Festuca pratensis</i>) ..	7	23	23	15
Meadow-foxtail (<i>Alopecurus pratensis</i>) ..	33	33	33	40
Paspalum (<i>Paspalum dilatatum</i>) ..	8	57	57	87
Poa pratensis ..	16	29	30	37
Poa trivialis ..	6	9	9	17
Prairie-grass (<i>Bromus unioloides</i>) ..	5	27	27	27
Red-top (<i>Agrostis palustris</i>) ..	2	2	2	9
Yarrow (<i>Achillea millefolium</i>)* ..	14	20	20	17
Other grasses, &c. ..	10	11	12	24
Totals ..	2,989	5,667	5,750	6,459

* Included here for convenience.

Table 5—continued.

Species.	1931.			1930.
	Purity Tests.	Germination Tests.	Samples.	Samples.
<i>Clovers, &c.</i>				
White clover (<i>Trifolium repens</i>) ..	490	590	632	523
Red clover (<i>Trifolium pratense</i>) ..	194	408	419	412
Alsike (<i>Trifolium hybridum</i>) ..	40	79	82	69
Alsike and white clover (mixed) ..	16	32	32	32
Subterranean clover (<i>Trifolium subterraneum</i>)	12	44	44	37
Strawberry clover (<i>Trifolium fragiferum</i>)	4	6	6	5
Crimson clover (<i>Trifolium incarnatum</i>)	1	8	8	19
Suckling clover (<i>Trifolium dubium</i>) ..	12	18	19	28
Lucerne (<i>Medicago sativa</i>) ..	13	66	67	50
Trefoil (<i>Medicago lupulina</i>) ..	4	21	21	21
Lotus major ..	23	35	36	48
Lotus hispidus ..	5	10	10	17
Other clovers, &c. ..	10	16	16	31
Totals ..	824	1,333	1,392	1,292
<i>Roots and Cruciferous Forages.</i>				
Swede (<i>Brassica campestris</i>) ..	..	245	245	231
Turnip (<i>Brassica rapa</i>) ..	1	370	370	337
Rape (<i>Brassica napus</i>) ..	1	103	103	116
Kale (<i>Brassica acephala</i>) ..	1	92	92	82
Mustard (<i>Brassica arvensis</i>) ..	..	21	21	19
Mangel (<i>Beta vulgaris</i>) ..	1	172	172	182
Carrot (<i>Daucus carota</i>) ..	..	68	68	79
Totals ..	4	1,071	1,071	1,046
<i>Cereals, Vegetables, &c.</i>				
Oats (<i>Avena sativa</i>) ..	..	59	59	65
Wheat (<i>Triticum vulgare</i>) ..	..	29	29	24
Barley (<i>Hordeum vulgare</i>) ..	..	24	24	20
Rye-corn (<i>Secale cereale</i>) ..	..	9	9	7
Vetches (<i>Vicia</i> spp.) ..	..	4	4	2
Peas (<i>Pisum sativum</i>) ..	2	251	251	220
Japanese millet (<i>Echinochloa frumentacea</i>)	..	17	17	18
Other forages ..	..	13	13	13
Vegetable seeds (other than peas) ..	..	368	368	369
Flower-seeds ..	..	32	32	43
Forest-tree seeds ..	..	5	5	2
Seed mixtures ..	30	131	34	42
Totals ..	32	942	845	832

GRASS-SEEDS.

Tables 6, 7, and 8 present various data in relation to the purity and germination of the principal species of grass-seeds.

Rye-grass.—The average germination percentage of all samples of perennial rye-grass showed an improvement over that for the previous

year, 33 per cent. of the samples germinating over 90 per cent., compared with 7 per cent. for 1930. Seed from Hawke's Bay, Poverty Bay, Sandon, and Canterbury districts was much superior than for three years past, just on 90 per cent. of the samples in all four groups showing over 90 per cent. germination. With the exception of the seed grown in Southland and parts of Otago, certified lines were all of a high purity and germination.

The low germination capacity of the Southern seed has been shown to be due to an abnormal seed condition, the incidence of which is associated with high atmospheric humidity. (See *Journal*, May, 1932, page 316.) The unusually low average germination obtained for Hawke's Bay and Poverty Bay seed during the previous three seasons (1928, 1929, and 1930) has been ascribed to the same cause, and it can be stated that the success of the production of perennial rye-grass seed in New Zealand is, from the point of view of germination capacity, dependent upon the climatic conditions of the district of production, and that only in districts with hot dry summer climates can high-quality seed be produced with any degree of certainty.

Awed seeds of Italian rye-grass occurred in 70 per cent. of all samples marked perennial rye-grass—in 83 per cent. of Southern, 60 per cent. of Canterbury, 48 per cent. of Sandon, 38 per cent. of Hawke's Bay, 50 per cent. of Poverty Bay, and 16 per cent. of certified samples.

Untabulated Grass-seeds.—The average percentage germination of the grass-seeds not included in the tables are as follows: Meadow-fescue, 80; *Poa trivialis*, 67; ratstail, 50; red-top, 97; tall fescue, 86; prairie-grass, 87; *Agrostis maritima*, 97; *Phalaris bulbosa*, 17; yarrow, 79.

Table 6.—Average Percentage of Seed Impurities and Germination of the Main Species of Grass-seeds (all samples), 1931.

Species.	Average Percentage of Seed Impurities.		Percentage of Germination.				Percentage of Samples Germinating in Groups.				
			Average.		Maximum.	Minimum.	Below 60.	60-69.	70-79.	80-89.	90-100.
	Crop.	Weeds	1931.	1930.							
Perennial rye-grass ..	0.8	0.6	80	70	99	6	10	9	21	27	33
Italian rye-grass ..	0.1	0.4	88	75	99	15	5	4	11	21	59
Western Woihs ..	0.1	0.3	90	73	99	42	7	6	3	8	76
Cocksfoot ..	4.3	0.3	75	68	97	Nil	10	18	28	32	12
Crested dogstail ..	1.8	0.3	87	88	99	39	2	5	12	32	49
Chewings fescue ..	0.8	0.2	91	81	99	2	3	2	3	12	80
Brown-top ..	0.1	0.6	94	95	99	25	1	2	1	5	91
Timothy ..	0.2	0.1	87	89	99	1	11	1	..	4	84
Fog ..	7.7	2.1	92	90	98	74	..	..	2	13	85
<i>Poa pratensis</i> ..	0.1	0.4	65	61	91	13	28	28	28	10	6
							0-29	30-39	40-49	50-59	60-100
Meadow foxtail ..	4.0	2.1	50	46	91	1	17	16	10	6	51
Danthonia spp. ..	8.7	9.9	41	49	85	Nil	33	17	16	22	22
Paspalum ..	0.1	0.3	46	23	66	2	28	12	21	32	7

Table 7.—Average Percentage of Germination and Seed Impurities of the Main Grass-seeds grouped according to Origin, 1931 and 1930.

Samples.			Average Per- centage of Seed Impuri- ties.	Percentage of Samples germinating in Groups.								Average Per- centage of Germi- nation.		Number of Samples.	
				Below 70.		70-79.		80-89.		90-100.					
				1931	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931	1930
Perennial Ryegrass.															
All samples	..	..	1.4	19	40	21	32	27	21	33	7	80	70	2,083	2,136
Southern	..	..	1.1	27	40	30	36	35	19	8	3	74	72	1,204	996
Canterbury	..	..	1.5	9	25	9	22	20	33	62	20	89	78	241	197
Sandon ..	..	..	0.8	14	82	13	9	21	1	52	8	87	48	75	86
Hawke's Bay	..	..	3.3	1	46	3	28	12	21	84	5	93	67	351	543
Poverty Bay	..	..	1.2	8	70	9	16	14	7	69	7	88	59	64	82
All certified	..	..	2.9	7	45	1	33	3	16	89	6	91	68	302	119
North Island certified	..	..	3.3	..	45	..	33	4	16	96	6	96	68	257	119
Canterbury certified	..	..	0.8	..	..	..	..	..	100	..	95	..	22	..	..
Southland certified	..	..	0.9	96	..	4	..	..	..	..	27	..	23	..	..
Cocksfoot.															
All samples	..	..	4.6	28	45	28	36	32	15	12	4	75	68	396	434
Imported	..	..	0.7	70	44	7	36	13	20	10	..	57	68	31	52
Akaroa ..	..	..	3.3	17	51	36	36	32	10	15	3	77	70	75	86
Plains ..	..	..	5.1	25	46	32	25	35	20	8	9	77	71	142	107
Crested Dogtail.															
All samples	..	..	2.1	7	6	12	7	32	25	49	62	87	88	768	871
Chewings Fescue.															
Southern (all samples)	..	..	1.0	5	12	3	13	12	45	80	30	91	81	827	1,003
Brown-top.															
All samples	..	..	0.7	3	1	1	2	5	5	91	92	94	95	450	750
Certified*	..	..	0.7	3	..	..	..	1	3	96	97	94	97	80	83

* Southern and Canterbury.

Table 8.—Average Percentages of Pure Seed, Germination, &c., of Samples tested according to International Rules.

Seeds.	Purity.				Percentage of Germination of Pure Seed.	Percentage of pure germinating Seed.
	Pure Seed.	Other Crop Seed.	Weed Seed.	Inert Matter.		
Certified perennial ryegrass—						
All samples ..	96.3	1.2	1.7	0.8	91.0	87.6
North Island ..	95.9	1.5	1.8	0.8	96.3	91.1
Canterbury ..	97.8	0.2	0.6	1.4	95.2	93.1
Southern ..	97.8	0.4	0.5	1.2	27.4	26.9
Brown-top—						
All samples ..	97.6	0.1	0.6	1.7	94.3	92.1
Certified seed ..	98.5	0.1	0.6	0.8	94.4	93.3
White Clover—						
Certified seed ..	94.4	3.8	0.7	1.1	83.4	78.5
Red clover ..	99.4	0.1	0.2	0.3	96.0	95.4
Cocksfoot ..	84.0	1.7	0.2	14.0	82.0	68.0
Chewings fescue ..	97.8	0.4	0.2	1.6	92.4	87.9
Crested dogstail ..	99.2	0.5	0.3	0.2	88.4	87.8
Meadow-foxtail ..	61.4	4.0	2.1	29.4	50.3	32.5
Yorkshire fog ..	84.3	8.4	3.3	2.8	93.2	77.8
Agrostis maritima ..	97.4	0.1	0.2	2.3	97.0	94.4

CLOVERS AND RELATED SPECIES.

The average percentages for the main clovers and related species are shown in the following table:—

Table 9.—Average Percentage of Seed Impurities and Germination of the Main Clovers and of Related Species according to Origin.

Seed.	Average Percentage of Seed Impurities.		Average Percentage of Germination.		Percentage of Samples germinating in Groups.			Average Percentage of Hard Seeds.
	Crop.	Weed.	1931.	1930.	Below 80.	80-89.	90-100.	
White clover—								
All samples ..	4.5	1.1	84	83	21	34	45	10.5
Certified ..	3.8	0.7	83	83	32	28	40	14.6
New Zealand uncertified	4.6	1.1	86	83	47	34	19	10.6
Imported ..	0.6	1.1	85	78	12	63	25	1.2
Red clover—								
All samples ..	0.1	0.4	88	87	11	27	62	5.2
New Zealand ..	0.1	0.3	89	89	11	27	62	5.2
Imported ..	0.1	0.1	75	76	25	25	50	3.9
Alsike ..	2.1	0.2	81	86	36	34	30	5.9
Subterranean clover ..	0.1	..	82	76	50	43	7	16.0
Strawberry clover ..	8.4	0.2	81	82	34	33	33	14.0
Crimson clover ..	0.1	..	70	77	26	12	62	0.5
Suckling clover ..	16.7	8.5	71	51	72	22	6	19.3
Lucerne ..	0.7	0.2	74	82	60	23	17	13.5
Trefoil ..	0.1	0.1	79	86	40	30	30	2.0
Lotus major ..	11.2	0.9	76	65	63	23	14	11.4
Lotus hispidus ..	40.6	0.3	60	47	100	..	..	21.5

The average germination percentages of other clover seeds, &c., not included in Table 9, are as follows: Lotus corniculatus, 59; Bokhara clover, 18; sweet clover, 62; alsike and white clover (mixed), 76.

ROOTS AND CRUCIFEROUS FORAGES.

The average germination percentages of these seeds are as follows:—

Table 10.—Average Germination Percentages of Roots and Cruciferous Forages.

Seed.	Percentage of Germination.				Percentage of 1931 Samples germinating in Groups—				
	Average.		Max.	Min.					
	1931.	1930.	1931.	1931.	Below 60.	60-69.	70-79.	80-89.	90-100.
Swede ..	82	84	99	Nil	11	7	11	28	43
Turnip ..	90	89	99	1	2	3	7	21	67
Rape ..	92	93	99	33	1	..	4	24	71
Kale* ..	84	80	98	8	7	3	11	32	47
Mangel ..	80	64	96	Nil	13	5	14	34	34
Carrot† ..	71	66	89	23	33	26	30	11	..

* Includes chou moellier.

† Garden and field varieties.

CEREALS, VEGETABLES, ETC.

The average percentage of germinations of cereals, vegetables, &c., are shown under the various headings as below :—

<i>Cereals, &c.</i>					
	Per Cent.		Per Cent.		Per Cent.
Oats ..	81	Rye-corn ..	77	Flax (<i>Linum</i>) ..	86
Wheat ..	94	Tares ..	61	Blue lupin (<i>Lupinus angustifolia</i>) ..	89
Barley ..	77	Japanese millet ..	85		
<i>Vegetables.</i>					
Asparagus ..	65	Cucumber ..	86	Radish ..	82
Beet ..	75	Lettuce ..	89	Rhubarb ..	62
Broccoli ..	73	Leek ..	77	Spinach ..	62
Beans ..	91	Marrow ..	86	Tomato ..	82
Cabbage ..	79	Melon ..	48	Endive ..	95
Carrot ..	71	Onion ..	73	Squash ..	64
Cauliflower ..	73	Pumpkin ..	97	Parsley ..	58
Celery ..	84	Peas ..	90	Brussel sprouts ..	93
Cress ..	94	Parsnip ..	62		
<i>Flowers.</i>					
Antirrhinum ..	68	Phlox ..	66	Sweet william ..	90
Lobelia ..	85	Portulacca ..	88	Sweet peas ..	89
Stock ..	33				

EXPORTS AND IMPORTS OF GRASS AND CLOVER SEEDS, 1931.

Table II shows the quantities and values of the various seeds exported and imported for the year 1931, and the quantities only for the years 1928, 1929, and 1930.

Table II.—New Zealand Exports and Imports of Grass and Clover Seeds, 1928 to 1931.

Seed.	1928.	1929.	1930.	1931.		Increase or Decrease compared with 1930.
				Quantity.	Value.	
<i>Exports.</i>						
	Cwt.	Cwt.	Cwt.	Cwt.	£	Per Cent.
Red clover ..	1,495	994	2,393	3,224	12,422	+ 49
White clover ..	835	1,302	1,920	2,841	20,658	+ 32
Other clover ..	350	687	784	241	1,297	— 72
Total clovers	2,680	2,983	5,097	6,306	34,377	+ 23
Brown-top ..	1,131	3,473	4,697	2,496	13,474	— 47
Chewings fescue ..	17,124	16,888	12,806	14,860	71,757	+ 16
Crested dogstail ..	4,844	4,500	4,656	3,230	10,477	— 30
Rye-grass ..	20,581	25,915	5,954	9,398	11,728	+ 36
Cocksfoot ..	496	1,183	669	2,948	9,835	+ 300
Other grasses ..	3,382	3,116	2,681	1,810	3,895	— 32
Total grasses	47,558	55,075	31,463	34,742	121,076	+ 14
Total quantity	50,238	58,058	36,560	41,048	..	+ 12
Total value	£ 161,456	£ 182,537	£ 166,237	..	155,453	— 6

Table II.—continued.

Seed.	1928.	1929.	1930.	1931.		Increase or Decrease compared with 1930.
				Quantity.	Value.	
<i>Imports.</i>						
	Cwt.	Cwt.	Cwt.	Cwt.	£	Per Cent.
Red clover ..	762	1,288	712	166	490	..
White clover ..	1,748	1,258	345	24	174	..
Alsike ..	2,806	1,417	2,040	81	261	..
Other clovers ..	1,497	751	1,005	609	3,027	..
Total clovers	6,813	4,714	4,102	880	3,952	— 80
Cocksfoot	9,145	4,199	230	74	265	..
Lucerne ..	17	50	294	37	268	..
Paspalum ..	3,026	2,615	1,350	572	3,607	..
Poa pratensis ..	51	248	201	50	208	..
Rye-grass ..	20	855	4,347	348	651	..
Timothy ..	4,765	2,843	2,351	1,786	2,712	..
Other grasses ..	1,839	1,332	444	509	2,127	..
Total grasses	18,863	12,142	9,217	3,376	9,838	— 63
Total quantity	25,676	16,856	13,319	4,256	..	— 68
Total value	£ 101,373	£ 78,418	£ 42,407	..	13,790	— 67

Exports—The percentages of increase or decrease are shown for each kind of seed in the right-hand column. The most serious decrease is shown for brown-top and crested dogstail, while there was a substantial increase for cocksfoot and rye-grass. Although the quantity of rye-grass exported is still very much lower than it was prior to 1930, there is an overall increase in quantity of 12 per cent., but this is partly offset by a decrease in value of 6 per cent.

Imports.—A heavy fall in imports is shown for all seeds with the exception of "other grasses." A total decrease of 68 per cent. in quantity and 67 per cent. in value from the figures for 1930 constitutes the largest fall in seed imports for many years.

The assistance of Mr. J. Watt, of the Seed-station staff, in the preparation of the tabulations used in this report is cordially acknowledged.

Superphosphate and Sweet Vernal.—A Fields Division officer reports that a paddock on a farm at Springbank (Canterbury), on light shingly land, had run to sweet vernal. Strips of this field were top-dressed with super at rates of 4 cwt., 2 cwt., and 1 cwt. per acre. The application of super evidently made the sweet vernal more palatable than on the undressed areas, as the manured strips, especially the 4 cwt., were completely grazed down by sheep, leaving no seed-heads, while the unmanured area had a growth of 3 in. to 4 in., with a crop of seed-heads.

SEASONAL NOTES.

THE FARM.

Balanced Pasture-management necessary.

At this season consideration may opportunely be given to the fact that good pasture-management results from suitable blending and balancing of the influence of several separate practices. From this it follows that judicious attention and expense given to any particular practice may be partly or even wholly wasted if it is not suitably linked with attention to those other practices which should operate in association.

A topical instance is provided in really sound autumn or spring top-dressing not being fully effective, because its subsequent influence is not controlled and modified properly. It is well known that two adjacent farmers could obtain very diverse results from identical top-dressing programmes, even though they started with similar pastures. Frequently top-dressing not only meets the need of more feed for our stock, but also at the same time creates the need of measures which will deal effectively with the additional feed which it provides. Top-dressing normally results in the production not only of extra feed when it is badly needed, but also of extra feed when there would be sufficient without top-dressing. If this latter additional feed is not suitably used, and if it is allowed to lead, in late spring and summer, to the development of coarse stemmy growth, then the benefit conferred at one season by the top-dressing may be nearly, or even more than, counterbalanced by the undesirable later results.

Hence occasionally we find farmers condemning top-dressing without any real justification for doing so. If their experience is studied it will usually be found that top-dressing has done all that could reasonably be expected from it—it has created the extra growth. It is the farmer who is condemning it who has really failed—failed in not linking the top-dressing with other measures which will utilize properly the extra growth that has been produced.

This relation between top-dressing and other pasture practices is especially topical because between early spring and late spring there may readily occur, if weather conditions are favourable, a transition from bare and backward pastures to rapidly growing pastures producing feed in excess of the current requirements of the stock being carried. In such rapidly growing spring pastures originates much of the poor summer grazing management which leads to relatively unsatisfactory returns from top-dressing and other practices which in themselves are judicious means of increasing growth. Incidentally, it follows from the above considerations that the ultimate success of a top-dressing programme is dependent on the farmer as well as on the farm. Indeed, it would probably be safe to state that the full success of top-dressing is often dependent more on the farmer who applies it than on the farm to which it is applied.

The position may be summed up by saying that top-dressing properly fitted into a system of pasture-management may serve excellently to increase the amount of leafy growth that is so desirable, but if not suitably accompanied by other measures it may lead to earlier development of coarse stemmy growth, the reverse of the leafy growth which is desired. While poorly controlled summer growth commonly occurs in pastures which have not been top-dressed as well as on those which have been top-dressed, that on the top-dressed ones is almost certainly of more importance, because if it is not effectively handled the best possible returns from the outlay on top-dressing are not obtained.

Importance of proper Utilization of Pastures.

The preceding consideration indicates that in the approaching season of rapid growth the practices that insure effective utilization of pasture are of great importance. During recent years much attention has been given rightly to the task of increasing production, until the position reached on many farms is one in which the production of grass growth is more efficient than its utilization. The most important general feature of this position is that many farmers still do not realize that their utilization is relatively inefficient in the light of modern knowledge.

One of the prime causes of unsatisfactory utilization of pastures is the allowing of the growth to become too rank and mature during spring and summer. In comparison with early growth, rank stemmy growth is poor in the milk, and flesh forming compounds called proteins, poor in mineral matter required in milk and bone formation, and poor in digestibility. In brief the rank stemmy growth is poor in three characteristics in which feed value for butterfat and fat lamb production requires to be good. Sheep farmers generally know well that pasture growth of considerable length and maturity gives very unsatisfactory results in the grazing of sheep, and especially in recent years has it been realized that such growth is equally undesirable in the grazing of dairy cattle. To some farmers these facts may seem so well known as to make it somewhat futile to direct attention to them, but the position to be faced is that they are important facts, and that thousands of farmers take no special steps to apply them in their pasture-management.

The two main means of avoiding the excessive maturity of pasture growth that leads to poor quality feed are enclosure and systematic grazing, each of which should be in operation on many farms in the immediate future.

Reasonably good grazing management can be secured often on farms subdivided into from nine to twelve paddocks, enclosure of specially small paddocks for pigs, calves, &c., but frequently a greater number of paddocks would facilitate improved results. Hence many farmers who do not practice systematic grazing cannot advance lack of subdivision as a real reason for not doing so, for their farms are already subdivided closely enough to allow of much better grazing measures than they follow.

The essential steps in effective grazing on many farms are the following simple ones: (1) Rapid grazing of fields by relatively heavy stocking so that the duration of a grazing period is generally from one to three days; (2) subsequent "spelling" of the pastures to allow of recovery sufficient to give the amount of grazing already specified.

To enable successive grazing to take place at a suitable stage of growth it becomes necessary from time to time to drop out of the grazing programme any paddocks in excess of those required to meet the current feed requirements of the stock. It is the dropping of these paddocks which provides the scope for enclosure, for as the season advances it usually happens that more paddocks are dropped from the grazing than could be effectively utilized for haymaking.

Levelling out the Year's Feed Supply.

On all farms except those on which arable crops are dominant a matter of prime practical importance at this time of the year is the variation in the rate of pasture growth between one season of the year and another. When pastures are being considered as a direct source of stock feed the following facts relative to this variation are of moment: (1) The variation arises primarily because of differences either of soil moisture or of soil-temperature; (2) normally, farmers cannot exercise control over soil-moisture and soil-temperature sufficient to influence materially the pastures in a way that will even out the natural seasonal differences in their rate of growth.

The seasonal variation is so great that approximately 70 to 75 per cent. of the whole year's growth occurs in the period of four months' duration commencing about the middle of September. This variation constitutes a fundamental weakness in grassland as a sole direct source of stock-feed, since because of it, feed production from season to season does not coincide with the feed consumption that would give efficient feeding of farm stock throughout the year. Unless proper steps are taken to deal with the position, either the stock are subject to alternate periods of abundance and of scarcity, or the farm is understocked so that the stock carried may subsist during the period of low production, and feed is wasted during late spring and summer, or extra stock, which give relatively poor returns, are then bought in. The measures which usually meet the position effectively—ensilage and special cropping—are ones for which preparation usually should be in progress about this time.

The two main tasks relative to ensilage that at this stage call for attention are (1) the closing up of suitable pastures, which was discussed in last month's notes; (2) the construction of pits or trenches if these are still to be formed. Suitable sites for pits or trenches occur on a great many farms. If convenient terraces on which pits can be placed are not available, then it is often advisable to resort to trenches, which if necessary can often be satisfactorily located on level paddocks. In trenches, which are essentially shallow pits, silage has been conserved with wastage so slight as to be negligible. When the pit or trench system of ensilage can be adopted, it usually should be employed, as it minimizes wastage of crop material and is low in labour and equipment demands.

Special Cropping.

The general remarks relative to special forage-crops which appeared in last month's notes are applicable to current work. Of the crops therein mentioned the mangel is one which deserves special mention. A point about which many farmers seem to have incorrect views is the cost of the mangel. Although the mangel is a fairly expensive crop, it is not nearly so costly as some farmers seem to believe. Apart from specially abnormal conditions the total cost ranges from about £8 to £11 an acre, allowing standard charges for all cultural operations, materials, and rent. On the basis of the charges allowed in this estimate, a crop of 50 to 60 tons an acre should result. It is when the feeding-value of this crop is set against the cost that the true economy of the crop becomes fully evident. Assuming a 50-ton crop at a cost of £10 an acre, the cost becomes 4s. a ton. That the mangel is potentially a very cheap source of feed is made clear by considering this estimated cost in conjunction with the fact that when hay is worth £3 a ton, then on a feed-value basis mangels are worth 10s. a ton. It is of considerable practicable importance that many of the items included in a total estimated cost of £8 to £11 an acre would not call for direct outlay on a great many farms. Indeed, on many farms the direct extra outlay involved in growing a mangel crop would be less than £3 an acre.

The matters of seasonal importance regarding the mangel are: (1) It should be grown much more extensively, because it is potentially a very cheap source of winter and spring feed both for dairying and sheep-farming; (2) it responds profitably to high fertility, so that land intended for mangels, if not naturally rich, should be made so by the use of farm or artificial manure or both; (3) correlated with its response to high fertility is its profitable response to abundant cultivation both before and after seed-sowing.

Lucerne.

Because the outstanding merits of lucerne warrant for it much more attention than it has received, and because preparatory cultivation for lucerne establishment should soon be started, if it is not already under

way, it seems opportune to advise all interested that the needs, potentialities, and general management of this crop are discussed at length in the Department's recently published bulletin No. 155, "Lucerne on the Farm," which may be obtained free.

Potato-growing.

Over wide areas the main crop of potatoes may very suitably be planted in October. Successful crops of potatoes are most generally secured on rich open loams which have been left in a loose condition by cultivation. Three of the outstanding factors in success with the potato are: (1) The use of good seed—the fullest information on this point should be secured by all growers in view of relatively recent developments in regard to virus troubles and seed certification; (2) liberal manuring of the land to be used, if not naturally rich—even on rich soils fairly substantial dressings of superphosphate usually prove profitable; (3) adequate cultivation to provide a well pulverized relatively loose seed-bed.

—R. P. Connell, *Fields Division, Palmerston North.*

THE ORCHARD.

Spraying Operations.

Stone Fruits.—With the first appearance of aphid, either green or black, Black Leaf 40 should be applied at a strength of 1 in 800. Where it is intended to apply this wash alone the addition of soap (4 lb. per 100 gallons), hydrated lime, or casein spreader ($1\frac{1}{2}$ lb. per 100 gallons) will be necessary to release the nicotine. Should the application be made in conjunction with lime-sulphur (0.1 per cent. polysulphide content), as is done by some growers, there will be no need to add the soap or other materials. It is suggested that 1 pint of Black Leaf 40 be placed in 4 gallons of water to which has been added one of these materials, allowed to stand for fifteen to twenty minutes, and then placed in the spray-tank. More efficient control is obtained with the use of Black Leaf 40 if applied on a hot day, consequently the delay of a day or so may be advisable to await suitable conditions.

Apples.—What is considered by many to be the key application of late spring and summer for the control of codlin-moth, leaf-hopper, black-spot, and powdery mildew, is the calyx spray. It is advisable to apply this spray, if possible, before all the blossoms have fallen; this is essential with large areas, so that the application can be completed before the calyx lobes close. Apart from the desirability of depositing some of the arsenate of lead in the calyx end this early application is necessary where mildew is to be controlled and where leaf-hopper has made its appearance. The mixture recommended is water 100 gallons, arsenate of lead $1\frac{1}{2}$ lb., colloidal sulphur 2 to 3 lb., spreader $\frac{1}{4}$ to $\frac{1}{2}$ lb., Black Leaf 40 1 pint, lime-sulphur 0.1 per cent. (polysulphide content). This mixture, with the elimination of Black Leaf 40, is also suitable for pears.

Cultivation and Irrigation.

The working down of the soil into good tilth for the summer will now be one of the major operations.

At time of writing (31st August), the dry spell still continues in Central Otago, the rainfall for May, June, July, and August totalling approximately only $1\frac{1}{2}$ in., and for the first eight months of the year about 7 in. In consequence, irrigators should take advantage of the larger supply of water available in the early part of the season, so as to bring the soil into a reasonably moist condition.

The Orchardist's Nursery.

Apple stocks, mentioned in last month's notes, will have been lined out in nursery rows. The ground requires to be kept in good tilth, but care must be taken when hoeing or cultivating between rows not to disturb the grafts before a proper union has been made. These should be fit for transplanting during next winter in the nursery, where they will be worked over, either by budding the following summer or grafting twelve months hence.

Peach and apricot pits will require attention as soon as the seedlings are large enough to handle—say, 2 or 3 in. high. They should be carefully lifted with a garden trowel and planted in the nursery, as mentioned in July notes. If the soil is kept worked and growth encouraged many should be ready for budding in late summer or early autumn. Plum seedlings and cuttings that are starting to move should be kept worked between the rows. Every care should be taken not to touch them with the hoe, as the slightest jar will prevent them from rooting. For 3 in. or 4 in. from the ground, growths should from time to time be removed on the peaches, apricots, and plums; this will create a clean stem for budding.

Grafting.

The correct season for grafting is governed by the condition of the stock and scion; the former should be well on the move and making their first growths, and the latter still dormant. Much of this work is done during September and early October.

Frost Prevention.

An increasing number of growers are successfully adopting the oil firepot system for protecting their fruit crops and tomato plants from late spring frosts. No system is complete without a frost alarm, as the work is too exacting on the grower, both mentally and physically, for him to rely on alarm clocks or the prognostication of probable frosty nights. Considerable information on this subject has been published in earlier issues of the *Journal*, copies of which are still available, and further advice can be supplied by the Department to those applying for it.

—W. R. L. Williams, Orchard Instructor, Alexandra.

Citrus Culture.

Spraying: As the trees are now in active growth there will be very little danger of damage to the foliage by the use of an oil spray for the control of scales and other sucking insects. An oil emulsion should be applied as soon as the young growth has hardened. The use of white oils is now becoming general at a strength of 1-60 and 1-80, according to the brand. These oils are readily mixed, and there is not the same danger of any free particles of oil that often caused injury to the foliage when the ordinary red spraying oil was used. Moreover, they give a much more effective control.

Bordeaux 4-4-40 should also be sprayed when the bulk of the main spring blossoms have fallen, as a preventive of verrucosis and grey-scab. Later sprays at intervals of from three to four weeks should also be given in order to protect the young fruit.

Where thrips are in evidence Black Leaf 40 1-800 should be added to the bordeaux. It is evident that this pest is beginning to get troublesome in some localities, and growers should watch for its appearance and spray for its control.

Manuring: This season of the year is one of the best periods at which to apply manures. The quantity to be used would largely depend upon the age and size of the trees, soil conditions, and general state of the

orchard. Individual trees should always have attention. Young trees up to six years old should receive about 2 lb. of blood and bone with the addition of a small quantity of sulphate of potash. Trees that are bearing consistent crops should receive a much more liberal dressing of this mixture, with possibly the addition of some sulphate of ammonia. Whether the manures should be spread over the whole of the soil area or confined within a certain radius is a point upon which there is a great diversity of opinion. However, it is always advisable to confine it to within a limited circle for young trees, gradually extending as the trees get larger. After application, the manure should always be worked into the soil as soon as possible.

Cultivation: With the renewed activity of the trees during spring a fair amount of wood growth may be expected. This, of course, means root action also, consequently cultivation of the soil should have every attention. Where this is neglected it will very soon be reflected in the condition and health of the trees. The aim should be to cultivate the soil several inches deep right up to the tree, as cultivation of the surface soil will keep the roots to a lower level, while it will also conserve the moisture and thus enable correct functioning of the feeding roots.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Care of the Young Stock.

THE end of October should see all chickens hatched, if they are to have sufficient stamina to withstand the heat of the summer and make satisfactory development by the time the season of high-priced eggs arrives. It is a common experience for late-hatched chicks to grow well for a time, but when the hot weather arrives to make slow development, and in consequence to have a stunted appearance.

The necessity for feeding the young birds well and managing them with every care cannot be overstressed. Shade is a matter which must not be neglected; it is the only hope for late-hatched stock, but it is also essential for birds of every age. Green food is also an essential requirement for healthy development. Shelled oats are always a valuable addition in the diet of the growing birds. Gravel grit should be in reach of the chickens at all times, likewise broken oyster-shell; the former assists the birds to digest their food, while the latter is essential to provide lime for bodily requirements.

Every care should be taken to make houses fit to receive young stock after being transferred from the brooder, and to guard the birds against receiving any set-back. The houses should be thoroughly sprayed with a good disinfectant, and be otherwise made as sweet and clean as possible. Great importance attaches to having a fresh run for the chickens when they leave the brooder—a run that has been spelled for some time, especially where late-hatched birds are concerned. It is invariably the case that chickens will develop much more rapidly on such a run than they will on stale ground and grass.

Prevention of Disease.

It has frequently been emphasized in these notes that there is no satisfactory cure for advanced disease in poultry stock. Prevention is the one thing to aim at, and the first essential in this connection is to see that the birds possess the necessary constitution to ward off disease should this unfortunately appear. Possessing birds bred with the desired vigour, there is really no special skill required in maintaining them in a healthy condition. The next essential is cleanliness, and clean quarters and

surroundings must go hand in hand with good feeding—a plentiful supply of good nourishing food. Fresh air in the sleeping quarters is also important if disease is to be kept off, but it should be remembered that airy quarters do not imply a draughty building.

It is not on the properly managed poultry-plant that disease makes its unwelcome appearance, even where there are hundreds of birds run on an acre of ground. Disease is mostly found where the birds are accommodated in insanitary, draughty buildings, and are kept year after year on stale ground which is never purified by being turned up to the influence of the sun, sown down, and allowed to rest; on such plants, moreover, the birds are seldom fed and attended to as they should be.

In all branches of live-stock breeding the maintenance of constitution is recognized as the foundation stone, but with the high-type laying-fowl, upon which there is such an exceptional strain, constitution is of special significance. Constitution will never be maintained in a flock if the young stock bred of a laying strain are subjected to lice-infested quarters, stale runs, and low feeding, or, in other words, are subjected to conditions which may be regarded as inviting disease.

Disadvantages of Movable Houses.

Several times recently inquirers have asked if it would not be preferable to have movable houses for farm poultry instead of a fixed structure, as with the former the birds would pick up a good part of their living. To my mind there is nothing to be said in favour of having portable houses. It may be true that under special local conditions the birds would scratch up a part of their living in the form of insect life, fallen grain, seeds, &c., but as against this, the movable houses would make the work of attention, feeding, and watering, so heavy that the cost would counterbalance any possible advantage from free foraging. I have seen the movable house system adopted with four houses in a fairly large field. The result was that at feeding-time all the birds would be congregated near the gate through which the attendant entered with the food, while many would wander to the farmhouse, and, losing their bearings, would be found roosting in the trees and stables. Again, where the birds left their houses to be fed, it often happened that in the event of a rainstorm they all rushed into the nearest house, which would be overcrowded, while the others would be empty or have but a few birds in them. Where portable houses are employed the labour is considerable, and in wet weather is most disagreeable.

To get eggs in winter the birds should be provided with roomy scratching quarters and be fed inside, to obviate their having to wait about outside, possibly in heavy rain, for their feed. This is impossible with movable houses. With the accommodation handy, concentrated, and near the home-stead, the women-folk of the farm can attend to the feeding and watering of the birds in comfort and in any weather, while the eggs can be frequently gathered and be obtained in a clean condition. With portable houses and a free range the hens are encouraged to lay anywhere, with the result that the eggs are too often stale and dirty, and cannot be marketed with confidence. The portable house, from a general point of view, is at its best when used only in the warm months of the year for growing-stock, after they have been transferred from the brooder.

Corns.

The most common cause of corns in poultry is continuous hard pressure on the feet, such as is caused by the birds being compelled to exercise on hard or stony runs, or in flying down from a high perch to a hard floor. They are also sometimes brought about by a prick from a thorn when the birds are on free range, or when thistles, pieces of gorse, &c., have been among the litter used in the house. When corns are giving trouble the

only effective course is to find the cause, if possible, and remove it. The perches should not be higher than 18 in. from the floor of the house, and the floor should be covered to a depth of several inches with straw or similar material to provide a soft place for the birds to land when leaving the perches.

When a bird becomes affected with a corn, and is considered to be of sufficient value to receive personal attention, painting with iodine is a simple and often effective treatment. Another method is to treat with a bluestone solution. Dissolve a piece of bluestone about the size of a walnut in a pint of hot water, and when the solution is cool dip the affected foot into it, repeating this treatment daily for a week or more. Many poultry-keepers lance the foot immediately a corn is detected. This is not only a cruel practice, but it seldom has the desired effect. The corn or abscess should not be interfered with until it has reached a perfectly ripe condition, and at this stage it will probably make its appearance between the toes as well as on the ball of the foot. From these places the dry pus can be easily picked out by means of a small-bladed penknife. After this operation a few drops of peroxide of hydrogen may be dropped into the affected parts. In order to keep the wound clean the foot should be bandaged and kept soft with vaseline or similar preparation. The bird should not be allowed to perch, and should be provided with soft bedding until a cure is effected.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Artificial Feeding.

As advised previously, a strict watch should be kept on the food-supply. As the spring advances this matter becomes of paramount importance. On no account allow the stores to dwindle. The queen's laying-powers are to a large extent automatic—as she is fed so will she lay—and when food is abundant brood-rearing will be in proportion. Do not forget that artificial feeding is invariably stimulating, and once undertaken must be carried out regularly and systematically. It is poor policy to fill a hive with brood and then leave it to starve. Spring losses are usually due to lack of stores, and are therefore preventable on the part of the beekeeper. Feed sugar syrup only, in the proportion of 2 parts of water to 1 of sugar, and place in the feeder while slightly warm.

Providing Water.

In the absence of a natural supply, water should be provided. Bees require a good deal of water for brood-rearing throughout the whole season, and it often happens that numbers of bees are lost if water is not close at hand. Moreover, bees often become a nuisance at cattle-troughs and by congregating round domestic supplies. Where a large number of colonies are kept it is imperative that the beekeepers should see that the bees are well supplied.

Many contrivances are used for the purpose of supplying water. "Simplicity" feeders make excellent vessels for containing water, but they require to be filled frequently and occasionally cleansed. A good contrivance is to use a kerosene or petrol tin as follows: Having thoroughly cleansed the tin, punch in the bottom a hole about the size of a sixpence; through this hole pass a piece of clean rag so that the water will fall a drop at a time. Under the tin a container may be placed to catch the water, and this, if filled with sand, will afford an excellent watering-place for the

bees. The supply can be regulated according to the requirements of the apiary. Bees prefer to take water from damp situations, and they may often be noticed in numbers sucking water from the ground where there has been any overflow. Containers should be placed in a sheltered spot in the apiary.

Foul-brood.

At all times when examining the combs a strict watch should be kept for symptoms of disease. Beekeepers should never lose an opportunity of acquainting themselves with foul-brood in all its stages. At this season if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspicious and subjected to the test for foul-brood. If on opening the cell, when a sharp-pointed piece of stick is inserted, the dead imago can be lifted out complete in form, the beekeeper may conclude that if dry it is a case of starvation and if moist of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy ill-smelling mass, it may be concluded that the hive is diseased.

There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvæ. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage. The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty, they will almost invariably yield a scale if examined, and the hive should be marked for treatment.

There is a deeply rooted notion among beekeepers that foul-brood can be detected outside by the odour, and inexperienced beekeepers are often misled by this statement. However, where the glue-like smell is noticeable from the outside of the hive at a distance of a few feet it may be concluded that the colony is diseased beyond redemption. Fortunately such cases are rare.

Apiary Locations.

Perhaps there is no more important question for the beekeeper than location. Upon his ability to select a suitable district in which to start beekeeping will depend his future success. There are few districts in the Dominion where bees cannot be kept in small numbers, but successful establishment of a commercial apiary will largely depend upon the beekeepers knowledge of the nectar-secreting plants. It is generally recognized that the main nectar-flow in New Zealand is produced from white clover and catsear, but it will be found to be a distinct advantage if the apiary is established in a district near patches of native bush or where the golden willow is abundant. Most of the indigenous trees and willows flower early, and the nectar from these sources is very valuable to the beekeeper, as it provides ample stores in the spring.

In districts where the beekeeper has to depend entirely upon white clover a careful watch must be kept on the stores, and very often artificial feeding has to be carried on until the appearance of the clover-bloom. This is often expensive, and can be usually avoided by selecting a site where at least a moderate spring flow may be anticipated. The rich dairy pastures of both the North and South Islands, and localities where cattle-raising is carried on extensively, provide suitable sites for commercial apiaries, while country which is used for sheep-grazing is generally not profitable, as the clover pasture is usually eaten bare. Instances have come

under my notice where abnormal crops have been secured in purely sheep-country, but they are too infrequent to be taken into consideration, and consequently this class of country should be avoided. Essentially the main requirements are feed and shelter, and if the apiarist is fortunate enough to locate his bees in a position where there is an abundant supply of nectar-secreting plants, good shelter can be easily provided.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

OCTOBER sowings will include the half-hardy crops of dwarf and runner beans; the gourds—marrows, pumpkins, cucumbers, and melons; also the winter crops of savoy, red cabbage, kale, broccoli, cauliflower, leeks, and celery for planting out early in the New Year. These are all important crops and should be grown where the land is suitable.

Beans may be used in the pod, shelled, or dry. In the latter form the white, light green, and pale dun haricots are a popular nutritious vegetable. Stained seeds for sowing should be regarded with suspicion as possibly being infected with the bacterial wilt disease which has recently made its appearance here. If they are affected the trouble will soon develop in the young plants, with results fatal to cropping. A light, rich, warm soil is most suitable for this crop, and, where lime has been used, a dressing of an ounce or two of superphosphate to the square yard will be beneficial. Sow thinly—3 in. or 4 in. apart is not too wide—and leave about 2 ft. between the rows of dwarf varieties. The depth of the drills should be 2 in. or 3 in., the latter being adopted in the case of light land. The runner bean is of altogether a different botanical species from the kidney or French bean; it is a perennial plant, while the latter is an annual. For this reason runner beans may be planted where they can be cropped for two or three years before resowing in a fresh locality.

The ideal soil for gourds is friable, rich, moist, and really well-drained. Melons require also a warm climate; but even where that condition is present this delicious fruit is little grown except by our Native people, who raise very handsome specimens of rock and water melons. Apply 3 oz. or 4 oz. of a "complete" manure to the square yard, and sow ridge cucumbers and rock-melons 12 in. to 18 in. apart, with 5 ft. or 6 ft. between the drills. Water and pie melons, citrons, marrows, and pumpkins may be thinned to 3 ft. or 4 ft. in the drill, with 8 ft. or 10 ft. between the rows. Where a little shelter is needed to protect the plants in the early stages, a small sheet of oiled paper may be used. It should be supported with a couple of wire hoops to keep it off the ground, and a little soil placed round the edges to keep it in position. When the time comes to harden off the plants, lift the paper on the lee side for a while, after which it may be removed altogether.

For cabbage, kale, and other plants of this family beforementioned for winter cropping, fork over a piece of land in a sheltered place; give it a dressing of lime, and sow the seeds thinly, broadcast, and rake well in. A few branches of scrub laid on the surface of these seed-beds will afford shade and protection from birds until germination takes place.

Leeks and celery should also be sown to raise plants for setting out in December and January; any soil that is really rich and moist will suit these crops. The fine celery seed is usually sown thinly in boxes of light soil, and the plants are afterwards pricked out at a distance of about 2 in. apart; but it may be grown outside so long as the plants are pricked out to destroy the tap roots and induce good rooting. It should be remembered

that celery is a water-plant, and should never be allowed to become dry. Owing to the prevalence of leaf-spot fungus, it is usually necessary to spray the plants with summer strength bordeaux spray in the seed-beds and after setting them out.

Weeds and grass in odd corners may be mown from time to time before seeding, and placed in a pit to ferment with other waste of the kind that usually accumulates. It should be spread evenly and trodden down compactly to assist fermentation. In winter it will turn out much like ensilage, and, with green crops grown for turning under, it will maintain the supply of humus in the soil that is so necessary. There is the further advantage of keeping the place in better working-order and checking the spread of weeds by seeding.

For pot-plants and boxes of seedlings success depends chiefly on a good friable compost in sweet condition being available. This can only be obtained by special preparation a year or so before it is required. The main ingredient is a good fibrous turf, growing on a loam of good quality. It should be stacked compactly in a moist, well-drained position where it will decay, sweeten, and become friable by the time it is required. If it is inclined to lack humus the old hotbed manure may be incorporated in alternate layers. Any opportunities for obtaining these supplies for making a good compost heap should now be taken.

Tomatoes, Egg-plants, and Peppers.

Egg-plants and peppers are both rather more tender than the tomato plant; they should be planted out somewhat later when the danger from low temperatures is quite past, and given a sheltered position in the warmer localities. Set out about 18 in. apart with tips removed when about 6 in. high to make them branch out; they require very little further attention, except for a little feeding when the fruit is set.

The most critical operation with these half-hardy plants for outside cropping is that of hardening them off. If this is done suddenly they become stunted and take a long time to recover from the check. The boxes of plants should be prepared for the operation in the glasshouse by gradually lowering the temperature and keeping them slightly drier. They may then be removed to the cradles for hardening off during a period when fine weather may be expected. Careful attention for the ensuing fortnight should turn them out in good hardy condition for planting out for cropping. The last attention given should be a generous application of water the day before they are transplanted.

If the land is well charged with humus in a decayed condition, a dressing of bonedust has been ploughed under, and liming has been attended to, a moderate dressing of superphosphate shortly before planting is all that is usually necessary. Heavy dressings of manures, especially when the preceding crop has been generously treated, is a waste of money and predisposes the plants to disease, especially that known as stripe disease. The plants should be set deep and firm during good weather and when the soil is in a sufficiently dry friable state.

Under glass the tomato crop will be setting the fruit, and the success of this critical period of development depends very largely on maintaining a suitable atmosphere. Cold draughts, close humid conditions, and any sudden changes are inimical. Watering, when necessary, should be done in the morning; excessively high or low temperatures should be anticipated and the ventilators adjusted to maintain a warm buoyant atmosphere. In warm districts a little ventilation will be required now even at night. Unless glasshouse crops can be given this close attention they are rarely profitable.

Small-fruit Crops.

The cultivation between rows of bush fruits to suppress weeds and superfluous suckers and runners should be very shallow, as the fibrous roots are very near the surface, and any injury to them at this critical stage interferes with growth and fruit development. Strawberries may now be given a dressing of nitrogenous manure with advantage, just before applying the mulch. For the latter purpose clean baled straw that has been weathered to destroy seeds is very suitable, rushes and pine-needles are also sometimes used. To keep the berries free from grit thrown up by splashing rain something of this kind is usually necessary.

The Homestead Garden.

If flowering shrubs are studied it will be noticed that they flower best on the old wood; or young wood, that is, one-year-old wood; or the new wood, as do roses. On this chiefly the pruning treatment required depends. Early flowering shrubs of importance that carry their blossom on the young wood are the forsythias, lilacs, double-flowering peaches, the banksia rose, &c. These and others of their class are greatly benefited by cutting away the wood as soon as it has flowered, in order to admit light and air which are so necessary to the young growth that follows and is to flower next season. If favourites are given this attention their gratitude will be generously expressed by the enhanced display that will follow. Suckers also should be suppressed, as they represent so much energy wasted, and they diminish the light and air so necessary to develop flower buds. For this important reason all rank superfluous growth inclined to crowd the plants should be suppressed.

As the time is arriving for setting out summer bedding-plants, some preparation should be made. The fragrant stocks, the glowing zinnias, and the delicately-coloured asters each have their appeal and provide wholesome pleasure when well grown. This is best attained by strictly limiting the area planted and doing it well. The foreground of the shrubby border so often used is rarely suitable, as the interests of the respective crops often seriously clash. As the name bedding-plants indicates, they are best grown in beds or borders specially set aside for the purpose so that the proper treatment may be given. With the continuous cropping these beds receive, there is a danger of them becoming deficient in humus, without which good results cannot be obtained. It may be supplied now by turning in a good supply of decayed farm manure. If 3 oz. or 4 oz. of bonedust to the square yard is included, success should be assured if good plants are set out in a tasteful manner. An ounce or two of superphosphate to the square yard, hoed in shortly before planting, would supply their more immediate need for phosphates.

Good plants are dwarf, bushy, and well rooted. It is important they should be well hardened off and not suddenly transferred from the glass-house or hotbed, which would cause them to become stunted in their growth. Cheap plants are very tempting, and the assurance that they will make good is very plausible; but the practice previously advised to limit the area and do it well is the best policy.

—W. C. Hyde, *Horticulturist*, Wellington.

Sodium Chlorate and Piripiri.—By one summer spraying of 3-per-cent. sodium chlorate a farmer at Paraparaumu last season substantially reduced piripiri, though without eradicating it.

Ridding Broad Beans of Aphis.—A Dunedin gardener states that he has achieved excellent results in ridding broad beans of black aphis by spraying them with a solution made by dissolving a few packets of Epsom salts in a bucket of water. The solution in no way harmed the plants and they did not become reinfested.

WEATHER RECORDS: AUGUST, 1932.

Dominion Meteorological Office.

AUGUST was a cold month in all parts of the Dominion, but in the latter half there were a number of mild days. Rainfall was still below average over the greater part of the Dominion, but the heavy rain from the 27th to the 29th caused a considerable excess in most of Taranaki and in Southern Wellington. The low temperatures were mitigated by the abundance of bright sunshine.

Rainfall.—In the South Island only scattered parts of Canterbury and Otago had more than the normal rainfall. In the North Island, in addition to the areas above mentioned, parts of the Auckland Peninsula had more than the average. In Hawke's Bay and at many other places the month was a very dry one.

Temperatures.—The temperature was everywhere from one and a half to three degrees below normal. There were many severe frosts in the first half of the month and from the 22nd to the 26th.

Sunshine.—All parts had more sunshine than usual. Nelson recorded 233.7 hours and Blenheim 218.1 hours, while the total of 208 hours at Waimate was very much above the average.

Pressure Systems.—The month began with a continuance of the same type of weather as had ruled during July. Depressions were mainly of cyclonic form, with the centres pursuing tracks which kept to the north of New Zealand. The most important of these cyclones passed Norfolk Island on the 3rd, and its passage coincided with that of a westerly depression to the southward. From Norfolk Island it moved in a south-easterly direction, becoming deeper in the process. The southerly winds in the rear of this depression were very cold and strong, and peculiarly persistent. On every day from the afternoon of the 2nd when they first reached the southernmost portion of New Zealand until the evening of the 6th when they finally died away, they brought hail, snow, and winds of gale force to many places. At first the full severity of the southerly was experienced only in the far South, but gradually it spread northwards. The 5th was a particularly bitter day. Snow fell down to low levels over an area covering the greater part of the South Island, and all the interior and the high levels of the North. Even at Thames and on the Hauraki Plains there was a light fall. The Wairarapa suffered relatively the most severely, snow commencing on the night of the 3rd and not ceasing finally until the 6th. The total fall was the heaviest since 1918.

On the 7th an anticyclone moved on to New Zealand, the highest pressures being experienced in the South Island. This anticyclone maintained its position until the 13th, when it began to move away eastward. Barometers were at times very high. Although cyclones still continued to pass by to the northwards, bringing unsettled weather to varying proportions of the North Island, the weather was otherwise very fine. Many severe frosts were experienced, especially in the South Island.

The anticyclone just mentioned was the precursor of a more springlike weather regime. Following it, depressions, though well developed, were of the normal westerly type. From the 13th to the 15th, as the first of these depressions approached, occurred the first really mild weather for a long period. On the 15th the northerly winds freshened, and rain became widespread in western and northern districts. By the time the depression had passed on the night of the 16th almost general rains had been recorded, with heavy falls in many places.

Another rather vigorous westerly depression passed during the 21st to 22nd. Rains were fairly extensive, especially in western districts and the North Island generally. In the southerly which followed this storm snowfalls were again fairly widespread.

The last storm of the month was a double westerly depression, the primary being followed by a secondary. It was not deep as it crossed the Tasman Sea on the 26th and 27th, but on the latter day a sharp rise of pressure and a change to southerly winds extended rapidly from Tasmania across the South Tasman Sea to Southern New Zealand. By the morning of the 28th the southerly invasion had covered the South Island but appeared to have expended itself. Over the North Island, however, the northerlies not only continued to blow but freshened. Throughout the 28th the situation remained almost unchanged, light southerly winds prevailing to just beyond Wellington, while above them and to the northward blew a strong northerly current of warm air heavily charged with moisture. As a result, torrential rains occurred in the southern portion of the Wellington Province and adjacent parts of Cloudy Bay and the Marlborough Sounds where the northerly

winds were forced to rise over the southerly. On the high levels and even in the Town of Masterton there was a fall of snow. On the 29th the southerlies became stronger and extended farther northward, and there were more heavy rains. Following these rains unusually severe floods occurred in the Wairarapa and Manawatu districts. From Masterton to Lake Wairarapa it was said to be the severest flood for twenty years. The weather improved on the 30th, and the 31st was perfect.

RAINFALL FOR AUGUST, 1932, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitaia	3.71	13	1.24	5.21
Russell	3.76	12	1.26	4.78
Whangarei	3.08	20	0.71	6.46
Auckland	2.28	13	0.74	4.23
Hamilton	1.44	8	0.34	4.20
Rotorua	2.29	8	0.63	4.97
Kawhia	3.89	11	0.95	4.65
New Plymouth	5.57	14	1.45	5.46
Riversdale, Inglewood	13.20	12	4.89	8.80
Whangamomona	7.43	8	2.07	5.96
Eltham	10.46	10	3.23	5.07
Tairua	5.32	11	2.02	5.87
Tauranga	2.46	11	0.74	4.29
Maraehako Station, Opotiki	3.66	13	1.04	5.59
Gisborne	2.91	13	1.25	4.36
Taupo	2.46	10	0.86	4.12
Napier	0.89	16	0.22	3.50
Hastings	0.83	12	0.25	3.25
Taihape	1.94	11	0.77	2.81
Masterton	8.77	18	3.33	3.49
Patea	6.88	14	2.18	3.68
Wanganui	2.57	11	0.64	2.79
Foxton	4.00	7	2.05	2.90
Wellington	6.67	16	3.48	3.82
<i>South Island.</i>				
Westport	5.37	12	1.51	7.70
Greymouth	5.56	12	1.43	7.38
Hokitika	5.13	11	1.64	9.27
Ross	6.57	7	1.78	10.60
Arthur's Pass	7.05	5	2.30	11.76
Okuru	8.16	5	3.00	11.37
Collingwood	6.69	7	2.64	7.13
Nelson	2.51	8	1.06	3.03
Spring Creek	2.62	7	1.25	2.76
Hanmer Springs	3.30	10	0.74	3.41
Highfield, Waiau	2.60	8	0.85	2.45
Gore Bay	1.84	10	0.41	2.69
Christchurch	2.07	11	0.78	1.85
Timaru	1.31	8	0.60	1.48
Lambrook Station, Fairlie	1.55	8	0.62	1.53
Benmore Station, Clearburn	1.56	9	0.94	1.48
Oamaru	0.85	5	0.28	1.75
Queenstown	1.59	8	0.58	1.96
Clyde	0.49	4	0.19	0.80
Dunedin	1.77	9	0.46	3.09
Wendon	2.37	7	0.60	2.03
Gore	2.68	8	0.72	2.25
Invercargill	2.11	15	0.36	3.25
Puysegur Point	3.62	16	0.82	7.12
Half-moon Bay	1.87	12	0.52	4.53

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1931-32.

Lists of butter and cheese factory companies or proprietaries which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1931, to 31st July, 1932—are printed below. Eighty-seven butter-factories and twenty-five cheese-factories have gained a place in the lists this year, compared with eighty-four and twenty-one respectively for the previous year. Twenty-four butter-making companies averaged over 94 points, the highest individual average being 95.217. No cheese-manufacturing company obtained an average grade of 94 points, the highest average being 93.698. The lists include seventy-one butter companies whose produce is graded in the North Island, and sixteen butter and twenty-five cheese companies in the South Island.

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Butter-factories.				
Taieri and Peninsula (Dunedin)	54	Peninsula ..	64	95.217
Kokatahi ..	1144	Kokatahi ..	149	94.746
Golden Bay ..	146	Sovereign ..	608	94.739
Rangitikei ..	1360	Rangitikei ..	670	94.725
Levin ..	910	Lake ..	1,147	94.623
Moa Farmers' ..	341	Inglewood ..	1,024	94.471
Mangorei ..	345	Mangorei ..	790	94.454
Wangaehu ..	1326	Wangaehu ..	415	94.454
Midhurst ..	110	Rugby ..	1,183	94.444
Lepperton ..	49	Lepperton ..	45	94.404
Rata ..	938	Rata ..	672	94.397
Inter-Wanganui ..	6	Inter-Wanganui ..	93	94.346
Uruti ..	300	Uruti ..	205	94.325
United ..	1296	Whariti ..	117	94.275
Tarururangi ..	728	Champion ..	95	94.272
Awahuri ..	664	Red Rose ..	689	94.211
Kaikoura ..	302	Kai ..	265	94.149
Maketawa ..	342	M.D.C. ..	256	94.140
Rongotea ..	8	Rongotea ..	642	94.066
Arahura ..	1516	Arahura ..	48	94.063
West Coast Farmers' ..	675	Silver Pine ..	55	94.055
Tikorangi ..	102	Shield ..	384	94.043
Rangiwahia ..	750	Quail ..	213	94.041
Shannon ..	1489	Shannon ..	871	94.007
Waitaki ..	812	Waitaki ..	14	93.978
Waitara ..	726	Waitara ..	479	93.966
Golden Coast ..	387	Golden Dawn ..	32	93.872
Tarata ..	631	Tarata ..	114	93.746
Farmers' Dairy Federation (Invercargill)	336	Murihiku ..	413	93.740
Apiti ..	414	Apiti ..	262	93.707
Golden Coast ..	991	Golden Coast ..	104	93.700
Okau ..	872	Okau ..	173	93.682
Bell Block ..	488	Bell Block ..	142	93.679
Okoia ..	413	Okoia ..	544	93.662
New Zealand (Ngatea) ..	291	Anchor, Acorn, &c. ..	1,500	93.654
Wairoa ..	1345	Wairoa ..	531	93.625
Omata ..	82	Omata ..	428	93.603
Te Aroha ..	344	Overseas, &c. ..	1,239	93.591
North Taranaki ..	723	Flax ..	457	93.586
Taihape ..	1188	Tikapu ..	198	93.541

LEADING FACTORY AVERAGES—*continued.*

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Butter-factories—<i>continued.</i>				
Pio Pio	603	Pio Pio	485	93·522
Wellington Municipal Milk	202	Rahui	98	93·512
Kaitaia	1298	Kaitaia, Manuka ..	1,343	93·502
Stratford	68	Stratford	801	93·494
Opotiki	337	Opotiki	1,403	93·491
Kairanga	1768	Longburn	279	93·489
Co-operative of Otago ..	266	Huia, &c.	455	93·482
Raetihi	717	Raetihi	202	93·462
Farmers' Dairy Federation (Gore)	165	Gore	165	93·443
New Zealand (Frankton Junction)	1510	Anchor, Acorn, &c...	1,515	93·415
Hinuera	329	Hinuera	776	93·401
Hauraki Plains	1900	Hauraki Plains ..	2	93·365
Matakana	1375	Matakana	254	93·355
Cheltenham	3	Pakeha	1,725	93·349
Tauranga	1478	Tauranga	945	93·329
Bay of Islands	1312	Bay of Islands ..	875	93·315
Morrinsville	330	Lockerbie, &c. ..	1,947	93·313
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula, &c.	159	93·301
Taihape	1188	Tikapu	234	93·300
New Zealand (Waharoa)	293	Anchor, Acorn, &c...	3,649	93·300
New Zealand (Waiuku) ..	111	Anchor, Acorn, &c...	2,168	93·290
Whakaronga	1709	Whakaronga	182	93·261
Kia Ora	926	Kia Ora	1,086	93·225
Hokianga	1843	Hokianga, &c. ..	1,025	93·225
Ruawai	66	Ruawai	1,007	93·225
Kaikohe	40	Kaikohe	237	93·210
Hikurangi	303	Hikurangi, &c. ..	1,420	93·207
Waitaki (Dunedin)	1013	Waitaki	9	93·198
Norsewood	600	Norsewood	600	93·193
Northern Wairoa	1358	Northern Wairoa ..	2,149	93·193
Kaipara	794	Poplar, Filbert, &c.	2,075	93·181
New Zealand (Paerata) ..	109	Anchor, Acorn ..	2,776	93·172
Kati Kati	1305	Kati Kati	554	93·166
Rangitaiki Plains	133	Rangitaiki Plains, &c.	2,924	93·140
Northern Wairoa	4	Northern Wairoa ..	571	93·133
Taupiri	43	Signal, Ensign, &c.	1,088	93·132
Caroline	236	Caroline	81	93·118
Alpine	792	Pine	18	93·110
Mid-Canterbury	35	I.X.L.	3	93·094
Murchison	1888	Airship	163	93·093
Whangarei	1720	Kauri, &c.	2,048	93·081
New Zealand Dairy Union	100	Hinemoa	595	93·075
Raglan	1470	Raglan	411	93·052
Springhead	180	Springhead	119	93·043
Tamaki	1463	Bell	252	93·021
East Tamaki	301	East Tamaki	1,527	93·000
Waipu	1248	Waipu	421	93·000

Cheese-factories.

Barry's Bay	401	Onawe	191	93·698
Cam	168	Cam	67	93·623
Edendale	36	Pioneer	664	93·553
Milton	1030	Milton	105	93·512
Mabel	29	Mabel	147	93·412
Oware	662	Oware	154	93·403
Seaward Downs	702	Seaward Downs ..	508	93·375

LEADING FACTORY AVERAGES—*continued.*

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Cheese-factories—<i>continued.</i>				
Little Akaloa	32	Little Akaloa	56	93.355
Omimi	74	Omimi	79	93.261
Thornbury	1581	Thornbury	405	93.223
Brydone	1821	Brydone	387	93.189
Island	72	Island	450	93.173
Waianiwa	1171	Waianiwa	133	93.166
Fairfax	1004	Fairfax	102	93.143
Otahuti	331	Otahuti	127	93.120
Kennington	205	Kennington	467	93.104
Stirling	292	Stirling	427	93.101
Ryal Bush	477	Ryal Bush	307	93.091
Kaitangata	1648	Kaitangata	118	93.087
Morton Mains	1604	Morton Mains	305	93.066
Woodend	1586	Woodend	91	93.059
Maungatua	1708	Maungatua	69	93.050
Paretai	271	Paretai	314	93.042
Tisbury	701	Tisbury	187	93.039
Grove Bush	1882	Grove Bush	58	93.014

—*Dairy Division.*

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING AUGUST, 1932.

Aucklander Short-top (N.Z. Sutton's Supreme.)

Crump, F., Springston.
 Poulton, A. D., R.M.D., West Eyreton.
 (Line A.)
 Roper, R. S., R.M.D., Halkett.
 Marshall, D., R.M.D., Leeston.
 Poulton, A. D., R.M.D., West Eyreton.
 (Line B.)
 Pirie, J., Kingsdown, Timaru.
 King, W. H., Rosewill, Timaru.
 Robinson, R. G., Box 4, Papanui.
 Wolff, R. G., R.M.D., Horrelville.
 Haines, C., 108 Waimak Road, Harewood.
 Warren, J., 149 Russley Road, Fendalton. (Line A.)
 Needham, M. R., North Road, Kaiapoi. (Line A.)

Dakota.

Cross, H. E., Sandy Knolls. (Line A.)
 Tweedy, S., R.M.D., Dunsandel.
 Walker, C. E., R.M.D., West Melton.

Aucklander Tall-top.

Cross, H. E., Sandy Knolls. (Line B.)
 Brown, H. M., 114 Withells Road, Riccarton.
 Doak, J. H., Barrhill, via Rakaia.

Arran Chief.

Knowler, H., Te Wae Wae, Southland.
 Saunders, E. E., Studholme Junction.

Arran Chief—continued.

Teschner, C. A., Chatton Road, Gore.
 Knowler, C. E., Happy Valley, Tuatapere.
 Bell, J. F., Stirling.
 Kirkpatrick, W. T., Airedale R.D., Oamaru.

King Edward.

Milburn, M., Wright's Bush, Invercargill.
 Burgess, D., West Plains.
 King, W. S., The Bend, Winton.
 Caulfield, J. T., Rakahauka R.D., Glencoe, Invercargill.
 King, L. A., Rakahauka R.D., Glencoe, Invercargill.
 Anderson, A., Stirling.
 Knowler, H., Te Wae Wae, Southland.

Bresee's Prolific.

Butcher, D. and M., R.M.D., Broadfields.

Majestic.

Robinson, R. G., Box 4, Papanui. (Line B.)

Early Rose.

Burns, R. A. C., Mead Settlement, Rakaia.

Robin Adair.

Marshall, D., R.M.D., Leeston.

Field Marshal.

Gray, J. L., St. Andrews.

—*Fields Division.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DOG WITH FOOT TROUBLE.

R. D. E., Havelock :—

One of my dogs at the beginning of January became very lame, and I found that the pads of his feet were raw, though he has no road work at all. The feet heal to a certain extent, and then apparently they irritate and he bites them raw again. Can you tell me if it is a disease and what treatment he should be receiving to effect a cure?

The Live-stock Division :—

It appears as if your dog is affected with chronic eczema of the foot. This trouble is persistent, and requires careful treatment to effect a permanent cure. The lesions heal to a certain stage, and at this stage it is necessary to apply a protective covering to the feet, and also perhaps a muzzle to prevent the dog from biting. If the eczema becomes moist at this healing stage it is advisable to apply a dry dusting powder composed of equal parts of boracic powder, zinc oxide, and powdered starch. This should be applied freely, and the feet require to be bandaged and protected. On the other hand, if the affected areas are dry and scaly, an ointment composed of equal parts of boracic and zinc ointments is required. Lead lotion applied on boracic lint might also give the desired results in this form. It is necessary in all cases to keep the feet protected with a covering to prevent biting and scratching, and allow recovery to take place. The feet should be carefully examined to see whether small cysts are present between the toes, as these may be the cause of the trouble reappearing. If cysts are present they require to be opened up with a lance and their lining painted with tincture of iodine. A tonic containing from 5 to 10 minims of Fowler's solution of arsenic may be given once daily in such obstinate cases.

PRAIRIE-GRASS.

"CLAUDE," Kiwitea :—

Please give me information regarding prairie-grass. I intend sowing 2 acres for cutting and carting in early spring to dairy cows. Please advise when to sow, amount, whether a nurse crop is needed, and what class of hay the grass would make later.

The Fields Division :—

Prairie-grass is of some value for producing feed from late autumn through the winter until spring. It has a shallow root-system, and is favoured by open fertile soil conditions. It is useful for mowing, but will not stand severe grazing. The hay obtainable from it is of good quality. About 60 lb. of seed to the acre should be sown. A mixture of prairie-grass with lucerne is likely to give good results. As the prairie-grass makes much of its growth in winter and early spring, and as lucerne grows chiefly in summer and autumn, the two plants do not compete directly with each other throughout. Prairie-grass is usually best sown in the autumn. A nurse crop is not recommended in establishing it.

SUPERNUMERARY TEATS ON HEIFER CALVES.

"SHORTHORN," Marohemo :—

Would you please advise some method for removing extra teats on heifer calves. It is found that at times milk develops in these, and also some are placed so as to be a nuisance for machine-milking.

The Live-stock Division :—

When calves have supernumerary teats they can be taken off with a sharp pair of scissors, and the part dressed with some tincture of iodine. The younger the animal the better the result.

SPRAYING FOR LATE BLIGHT ON POTATOES.

J.M., Oparau :—

Kindly advise me what spray to use and when to apply to prevent blight on potatoes. Would a knapsack sprayer such as one uses for ragwort be suitable for applying it?

The Fields Division :—

There are two commonly used sprays effective for controlling late blight on potatoes—namely, Burgundy mixture and Bordeaux mixture. Burgundy mixture is made by dissolving 4 lb. of bluestone in a 40-gallon wooden cask nearly full of water. This can be done by suspending the bluestone in a bag just underneath the surface of the water, when it will gradually dissolve. This done, dissolve 5 lb. of washing-soda in a small quantity of water and add to the bluestone solution, stirring vigorously the while. Then completely fill the barrel with water. This mixture is not quite as effective as the Bordeaux, but is more easily prepared and is the favourite mixture. Bordeaux mixture is prepared in the same way as the Burgundy, except that the 4 lb. of soda is replaced by 4 lb. of quicklime. The quicklime is prepared by adding a little water at a time very gradually at first, so that it forms a thick paste, then a thin paste, and then a fairly thick suspension solution. This is next added to the bluestone solution as in the case of the soda, stirring vigorously. The use of this mixture has been abandoned by many because pure unreverted quicklime has proved difficult to obtain. The spray should be used soon after the mixture is made. It should be applied first when the plants are about 6 in. high, then every fortnight or ten days till the crop is nearly mature. A knapsack sprayer would be quite suitable.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 14th July to 8th September, 1932, include the following of agricultural interest :—

No. 66431 : Manure-distributor ; J. Vorbach. No. 68787 : Milking-machine ; J. E. Haywood. No. 68820 : Milking-machine ; MacEwan's Machinery, Ltd. No. 66756 : Butter-box ; F. O. Viggers. No. 67306 : Weed-killing solution ; W. H. Bickerton. No. 67491 : Hay-collecting ; T. A. Tilt, T. A. Tilt, jun., and W. H. Tilt. No. 67537 : Pulsation control for milking-machines ; C. A. Davis and F. A. Stempa. No. 67697 : Lime and manure distributor ; A. W. Cargill. No. 68262 : Milking-machine pulsator ; F. C. Penfold. No. 68784 : Plough-share ; T. Redding and T. Mitchell. No. 68785 : Cradle for wire-banding cheese-crates ; D. A. Dunn. No. 66736 : Drying and preparing rennet casein ; N.Z. Co-operative Dairy Co., Ltd. No. 67308 : Hay-knife ; J. Irving. No. 67327 : Beehives ; O. Smith. No. 67563 : Tine harrow ; A. J. Bond. No. 67564 : Harrow unit ; A. J. Bond. No. 67435 : Milking-machine ; H. H. Johnson. No. 67685 : Harrow ; A. C. Sutherland. No. 67926 : Tine harrow ; J. W. Neate and C. G. McTaggart. No. 69027 : Sizing and grading fruit ; J. S. Tuckfield.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

Response to Potash on Grassland.—The Instructor in Agriculture, New Plymouth, reports : "The response to potash in North Taranaki is positive over a larger area than was at one time thought. We have yet to determine whether the response is an economic one, although the outstanding differences in some instances rather point to the results being payable."

Certified Rye-grass Pastures in Wairarapa.—The Fields Instructor at Masterton reported that after the rains last February areas sown down with certified rye-grass showed greater recovery from drought than pastures sown with ordinary commercial seed, and during the later dry spell held their growth better. This point was most outstanding and was remarked on by many farmers.